GEOGRAPHY,
RESOURCES & INDUSTRIES

April, 1943

EDISON ELECTRIC INSTITUTE BULLETIN

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KILOWATT GENERATOR CAPACITY OF ALL PLANTS CONTRIBUTING TO THE PUBLIC SUPPLY—Dec. 31, 1941 and 1942

	Total (All Plants)		Capacity of Generators Driven by: Steam (Engines and Turbines)		Hydro (Water Wheels and Turbines)		Internal Combustion (Engines)	
	1942	1941	1942	1941	1942	1941	1942	1941
Total United States	46,534,100	44,092,201	32,296,700	30,823,455	13,188,200	12,263,587	1,049,200	1,005,159
Maine	312,600	290,086	90,900	71,690	219,100	215,927	2,600	2,469
New Hampshire	315,500	315,175	80,400	80,430	233,500	233,595	1,600	1,150
Vermont	180,300	177,214	13,800	11,350	165,800	165,172	700	692
Massachusetts	1,400,500	1,367,252	1,224,200	1,194,195	167,300	164,062	9,000	8,995
Rhode Island	281,900	278,021	278,500	274,450	3,200	3,350	200	221
Connecticut	831,100	740,496	735,500	645,490	90,500	90,905	5,100	4,100
Total New England	3,321,900	3,168,243	2,423,300	2,277,605	879,400	873,011	19,200	17,627
New York	5,903,300	5,842,254	4,705,900	4,649,475	1,171,100	1,167,486	26,200	25,293
New Jersey	1,432,000	1,337,337	1,421,300	1,326,300	6,800	7,100	3,900	3,937
Pennsylvania	3,418,500	3,260,744	2,983,300	2,825,367	424,700	424,695	10,500	10,682
Total Middle Atlantic	10,753,700	10,440,335	9,110,500	8,801,142	1,602,600	1,599,281	40,600	39,912
Ohio	2,997,200	2,712,411	2,967,900	2,683,858	12,100	12,125	17,200	16,428
Indiana	1,386,600	1,378,461	1,324,500	1,316,525	38,500	35,494	26,600	26,442
Illinois	2,828,600	2,729,688	2,758,600	2,660,282	48,400	48,372	21,600	21,014
Michigan	2,240,700	2,233,708	1,843,600	1,847,825	350,900	350,335	46,200	35,548
Wisconsin	1,107,000	1,045,015	806,300	756,320	279,200	269,628	21,500	20,169
Total East No Central	10,560,100	10,099,263	9,700,900	9,263,810	726,100	715,852	133,100	119,601
Minnesota	762,100	707,163	557,400	507,309	157,400	157,629	47,300	42,225
Iowa	741,900	720,311	522,200	506,269	131,000	131,063	88,700	82,979
Missouri	856,600	852,155	643,000	639,993	158,400	158,370	55,200	53,792
North Dakota	96,100	93,848	85,300	85,338	-	-	10,800	8,510
South Dakota	90,400	86,921	55,100	52,362	3,300	3,295	32,000	31,264
Nebraska	417,600	419,840	221,100	223,661	142,500	142,600	54,000	53,579
Kansas	529,200	525,513	449,700	446,710	6,900	6,881	72,600	71,922
Total West No Central	3,493,900	3,405,751	2,533,800	2,461,642	599,500	599,838	360,600	344,271
Delaware	37,900	37,917	33,200	33,200	-	-	4,700	4,717
Maryland	805,900	750,319	524,000	469,325	271,400	271,385	10,500	9,609
District of Columbia	358,000	308,000	355,000	305,000	3,000	3,000	-	-
Virginia	669,800	670,301	474,700	474,710	181,500	183,174	13,600	12,417
West Virginia	832,700	793,268	726,800	687,410	101,000	100,980	4,900	4,878
North Carolina	1,427,700	1,311,045	644,300	573,791	772,800	729,430	10,600	7,824
South Carolina	792,500	658,778	137,300	137,330	650,700	518,128	4,500	3,320
Georgia	827,200	583,276	281,400	237,450	543,500	343,492	2,300	2,334
Florida	466,200	443,138	414,000	389,957	12,700	14,393	39,500	38,788
Total South Atlantic	6,017,900	5,556,042	3,590,700	3,308,173	2,336,600	2,163,982	90,600	83,887
Kentucky	460,000	410,268	346,000	296,070	110,900	111,065	3,100	3,113
Tennessee	1,014,900	707,208	312,100	192,622	700,900	512,402	1,900	2,184
Alabama	1,197,200	1,096,647	283,000	283,070	909,000	808,233	5,200	5,344
Mississippi	64,300	63,702	48,900	49,047	-	-	15,400	14,655
Total East So Central	2,736,400	2,277,825	990,000	820,809	1,720,800	1,431,720	25,600	25,296
Arkansas	157,100	154,566	73,600	69,600	67,000	67,008	16,500	17,958
Louisiana	427,600	425,094	383,400	380,620	-	-	44,200	44,474
Oklahoma	438,200	436,420	324,500	322,714	59,200	59,224	54,500	54,482
Texas	1,279,300	1,232,952	1,027,700	984,300	152,300	152,315	99,300	96,337
Total West So Central	2,302,200	2,249,032	1,809,200	1,757,234	278,500	278,547	214,500	213,251
Montana	338,300	336,645	12,200	12,218	323,200	321,565	2,900	2,862
Idaho	269,600	262,430	600	650	265,800	258,800	3,200	2,980
Wyoming	86,500	88,268	31,600	33,337	49,700	49,852	5,200	5,079
Colorado	314,100	317,247	231,300	235,969	66,200	66,150	16,600	15,128
New Mexico	144,900	144,125	99,900	99,879	25,100	25,157	19,900	19,089
Arizona	521,100	534,833	116,400	113,437	458,100	375,616	46,600	45,781
Utah	168,400	167,784	66,300	66,250	91,800	91,230	10,300	10,284
Nevada	509,500	509,416	2,500	2,900	504,000	503,890	3,000	3,026
Total Mountain	2,452,400	2,360,728	660,800	564,240	1,783,900	1,692,259	107,700	104,229
Washington	1,357,300	1,127,430	217,400	217,500	1,137,700	908,180	2,100	1,750
Oregon	838,100	807,148	188,200	192,200	648,000	612,698	1,900	2,248

EDISON ELECTRIC INSTITUTE BULLETIN

Volume 11 APRIL, 1943 No. 4

Wartime Lighting and Safety

By Edwin Vennard

Vice President, Middle West Service Company, Chicago

Presented before the Illuminating Session, 14th Annual Safety Convention and Exposition, Greater New York Safety Council, New York, March 22 - 24, 1943

IN the present all-out war effort, our primary and immediate objective is the maximum utilization of material, man-power and time. Men in positions of governmental authority have a heavy responsibility of deciding on the most efficient use that can be made of the great resources this country is making available for the war program.

It is not only a responsibility of the American people to co-operate with government in carrying out decisions once they are made, but it is also our responsibility to co-operate with government in assembling the facts on which such decisions are to be based.

Any organization or individual in a position to gather pertinent statistics, to secure valuable information or otherwise contribute to the solution of problems which government must solve is under obligation to place such information before those responsible for making the decisions. Only in this way can we be assured that the best answer will be found. And, finding the best answer is a direct concern of every citizen.

Some decisions are in the making at this time. Some are of immediate concern to the purpose for which we are gathered here. We are in a position to procure and assemble data which are highly important to the making of wise decisions.

Specifically, the conservation of fuel is under serious consideration—not entirely as it relates to the source of supply, but likewise as it relates to the man-hours and equipment that can be released for other war work by reducing the production and transportation of fuel. The conservation method of particular concern to us is the reduction of lighting and the manner in which such reduction might affect safety and the man-hours of work.

For good reasons it has been considered advisable to widen dim-outs in our coastal areas and to practice black-outs in many other areas. Some consideration is being given to the advisability of extending the dim-out or a modification of it, sometimes referred to as a "brown-out," to other parts of the country.

The man-hour is one of the most important elements entering into the war effort. A lighting curtailment program to accomplish fuel conservation will result in a saving in man-hours.

It is estimated that the extension of the dim-out to a national basis will save the equivalent of 2 million tons of coal annually. It requires about 1.5 manhours per ton to mine this coal and 0.5 manhours per ton for handling and hauling it from coal mine to power plant.(1)

This represents a total saving of 4,000,000 man-hours a year. However, such savings should be weighed against any probable loss in man-hours caused by such a lighting curtailment program.

We have access to information and data bearing directly on the relationship between lighting and safety. While we do not presume to draw a conclusion, we do have the responsibility not only to make available the data already obtained, but also (and this may be of greater importance) to continue and expand our studies and make the results available to those who have the decision to make.

Considerable information and data have been accumulated over the past years from research dealing with the relationship between lighting and safety and production. A number of organizations devote their full time, or part time, to this subject. It will be the purpose here to review briefly some of these past studies so as to refresh our memory and to analyze them in the light of present conditions. Likewise a brief review will be made of some of the new data on the subject.

Before going into the question of lighting and safety, it is well to consider the factor of electric generating capacity although it appears that at the moment this is not an element causing consideration of further curtailment of lighting. At the end of 1942, electric utility companies had installed 47,000,000 kilowatts and were supplying all war and civilian needs. The non-coincident power loads for December, 1942, totaled 37,000,000 kilowatts thus leaving reserves of 10,000,000 kilowatts. The same margin of reserve capacity was increased during the year by 1,000,000 kilowatts. The total net increase in generating capacity scheduled for 1943 is 3,384,000 kilowatts.

Mr. J. A. Krug, Director, Office of War Utilities, War Production Board, said in an address delivered Feb. 16, 1943, at Chattanooga, Tennessee:

"The power men — public and private, in this area and throughout the country — should be proud of the job that has been done in providing power supply. Power has never been 'too little or too late.' There is today no shortage of power. This is in sharp contrast to the situation as to many other vital necessities. I do not know of a single instance in which the operation of a war plant has been delayed by lack of electric power supply."

(1) Edison Electric Institute—This is based on a saving of 1½ million tons of coal in coal burning plants. Coal represents about 80% of all fuel used in generating stations. Assuming the same saving for the 20% which oil and gas gives the equivalent of about 2,000,000 tons. To be conservative the same man-hours are assumed for oil and gas as for coal.

Parenthetically, that is a record of which we of the electric companies, which furnish about 7/8 of the nation's power supply, are proud.

Lighting and Safety

It is estimated that 200,000 soldiers, sailors and marines could have been supplied with war equipment produced in the time lost through accidents in 1941.[2]

In 1942 there were 93,000 accidental deaths and 9,300,000 persons were injured. This resulted in a loss of approximately 3¾ billion man-hours. One out of every 14 persons in the United States suffered a disabling injury in 1942.

The extent to which lighting was a contributing factor to all accidents is not definitely known. However, an indication can be had from a study of the records on some of the classes of accidents. For example, *Chart 1* shows a breakdown of the accidental deaths into four groups. The second largest is 27,800 deaths caused by motor vehicle accidents. Considerable information is available on the extent to which lighting was a factor here. Some information, although nearly enough, is available on the extent to which ligh is a factor in the occupational group in which 18,500 w killed. Practically no information is available on ligh as a factor in the accidents in the home or "public" accid other than motor vehicles.

Let us review briefly some of the records on lightin a factor in motor vehicle accidents.

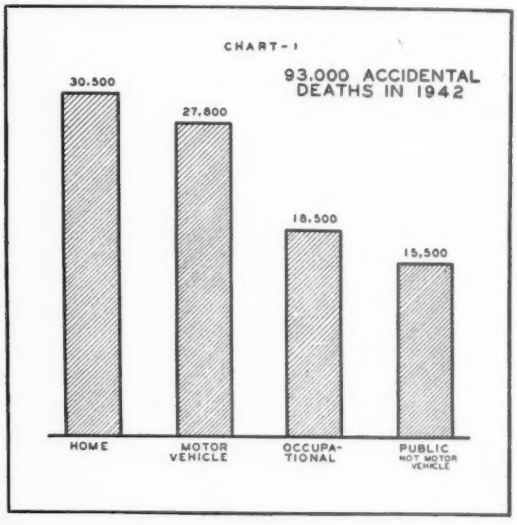
Chart 2 presents the latest statistics on automobile fa ities showing that 16,700, or 60 per cent of the 27,800 m vehicle accidental deaths in 1942 occurred at night. S only about *one-third* of the driving in 1942 was don night, the hazard of night driving is about three times hazard of day-time driving.

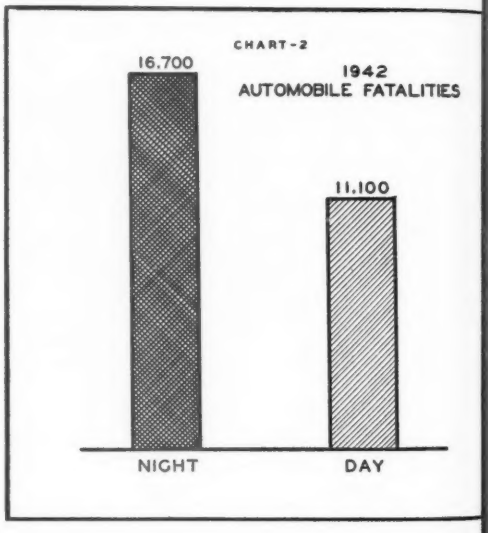
This is further illustrated in *Chart 3* which also incl non-fatal accidents.

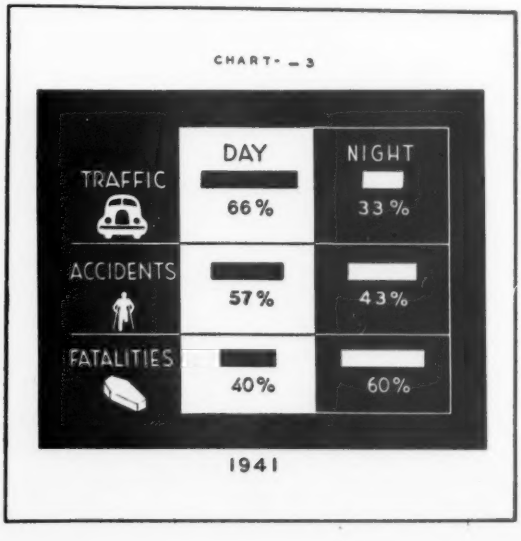
Now, let us review briefly some of the specific stu made to determine the effect of street lighting on night m vehicle accidents.

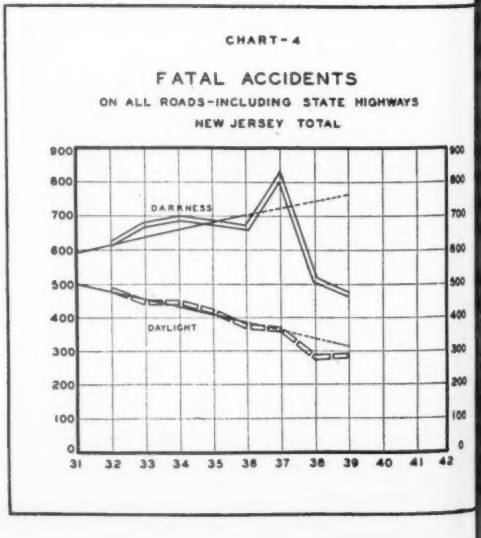
Chart 4 shows the record of fatal accidents in New J

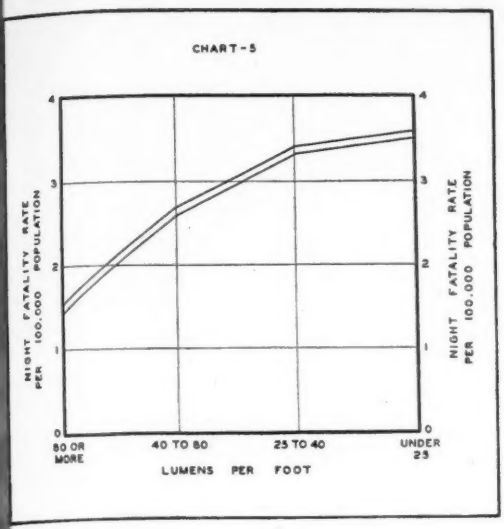
[2] 1942 edition "Accident Facts" by National Safety Council, Inc.

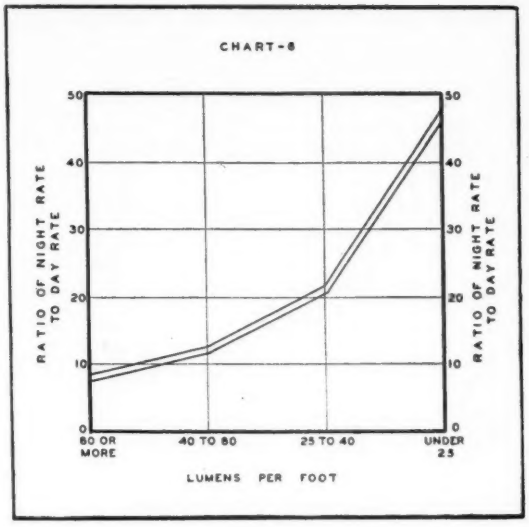












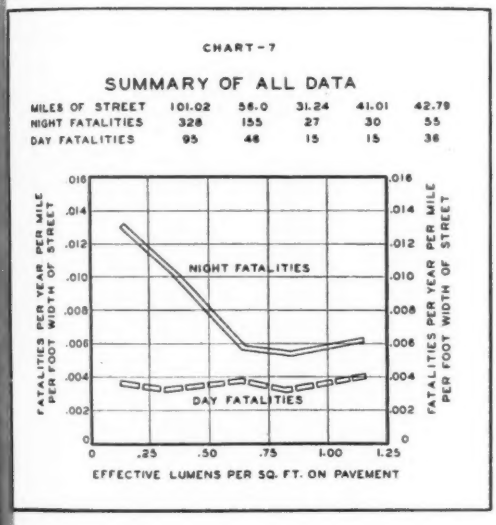
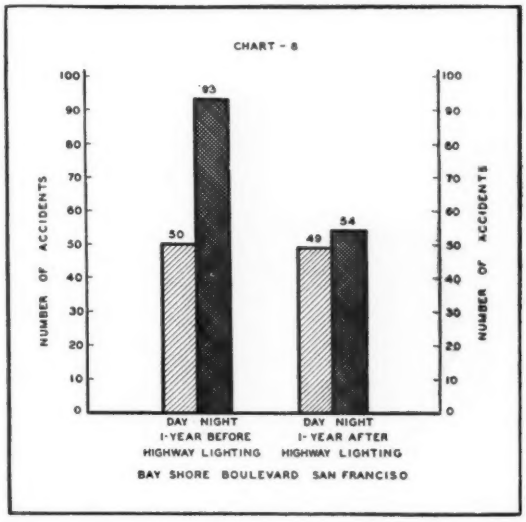


CHART-7
SUMMARY OF ALL DATA
MILES OF STREET 101.02 56.0 31.24 41.01 42.79
NIGHT FATALITIES 328 155 27 30 55
DAY FATALITIES 95 48 15 15 36
FATALITIES PER YEAR PER MILE PER FOOT WIDTH OF STREET
NIGHT FATALITIES
DAY FATALITIES
EFFECTIVE LUMENS PER SQ. FT. ON PAVEMENT



all roads including state highways from 1930 through 1939. The state improved lighting program became effective in 1937.[3] The sharp decline in fatalities at night speaks for itself.

In 1934 the National Bureau of Casualty and Surety Underwriters published a survey of 277 cities covering a three-year period. After averaging all of its findings, the survey showed that as the intensity of lighting on the same classifications of streets became progressively less, the night fatality ratio became progressively worse.

Chart 5 shows the result of this summary. This chart shows the marked increase in the night fatality rate per 100,000 as the lighting intensities decreased.[4]

As shown in *Chart 6* the ratio of the night rate to the day rate of fatalities per 100,000 increases even more steeply than the number of night accidents as the street lighting in the cities decreases. This would indicate that the effect of favorable traffic conditions which reduced the number of day accidents was more than overcome by reduced lighting.

In Detroit, 1932 depression economies resulted in a 35 per cent reduction in street lighting. The fatal night accidents in Detroit rose from 51 per cent of the total accidents in 1931 to 67 per cent in 1932 with the curtailed lighting.

With this experience, Detroit decided that "street lighting has a marked effect on the number of fatal night accidents and therefore proper and adequate street lighting should be considered as a traffic safety measure."

Chart 7 gives the results of an exhaustive study in Detroit showing the relationship between fatalities and street lighting intensities.[5]

* * *

A number of studies have been made to determine the effect on accident records of better lighting on particular highways.

[3] Booklet "Oh Say Can You See"—a detailed report on New Jersey Statewide Safety Lighting Program by E. R. Sherbaum, New Jersey State Highway Department.

[4] Booklet "Evidence About Your Fatal Streets"—Street and Highway Lighting Safety Bureau, 155 East 44th Street, New York City.

[5] "Public Safety in Detroit as Affected by Street Lighting"—A paper presented before the 35th Annual Convention of the Illuminating Engineering Society, Atlanta, Georgia, September 22-25, 1941, by L. J. Schrenk, General Superintendent Public Lighting Commission, Detroit, Michigan.

Chart 8 shows the result of such a study on Bay Shore Boulevard near San Francisco. This shows a decrease in the number of night accidents from 93 to 54, or about 40 per cent, after modern safety lighting was installed.

Chart 9 shows the result of a similar study on the Schenectady County Highways, New York.[6]

Hartford, Connecticut, experienced a marked decrease in night accidents with improved street lighting as shown in *Chart 10*.[7]

Similar results were experienced in Los Angeles as shown in *Chart 11*.[8]

All of these studies indicate that a marked decrease in accidents may be expected with improved street and highway lighting.

Increased Accidents Caused by Dim-out

Now let us look at some of the records on the change in the accident rate that can be traced to the decrease in light intensities caused by the dim-out.

A number of studies have been made to determine the effect on accidents as a result of the dim-outs in the coastal areas. This, of course, is in no way a criticism of the dim-out. Those responsible for such decisions consider it best in the war effort—and the co-operation of all is expected. However, it is well that we examine the results so far experienced so that we may be in a better position to judge the wisdom of extending the dim-out or of creating a brown-out.[9]

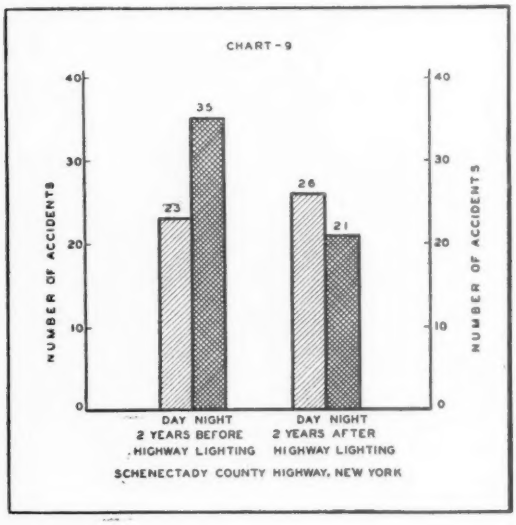
Chart 12 shows the results in Bridgeport and New Haven on the thoroughfares with modern lighting. The 1942 increase in daylight accidents over 1941 caused by the restric-

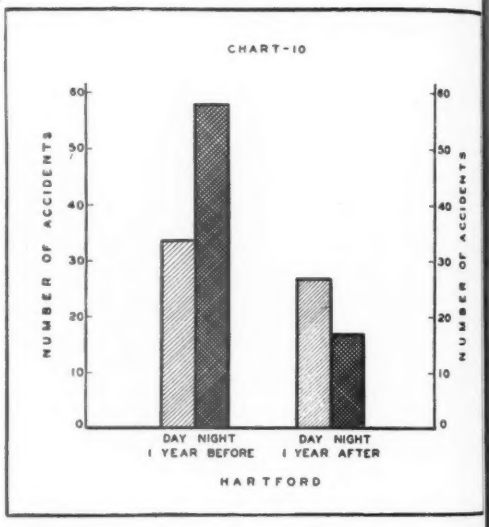
(6) "Seeing and Highway Safety—The New Science of Seeing Affords the Proper Approach" by M. Luckiesh, D.Sc., Director of Lighting Research Laboratory, Incandescent Lamp Department, General Electric Company.

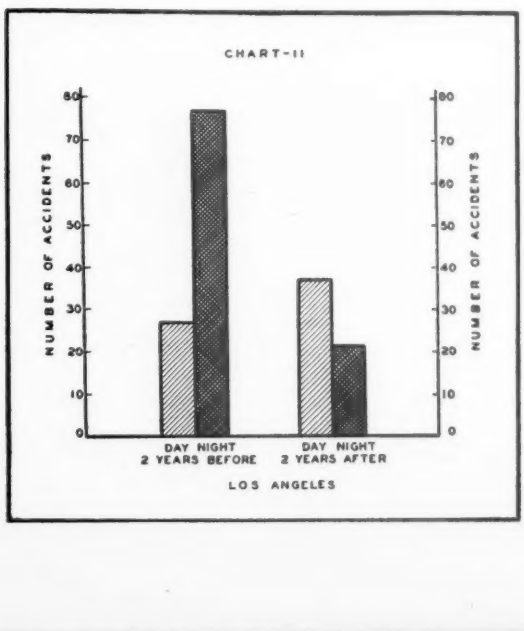
(7) "Night Safety Bought Cheaply"—Report of the Subcommittee on Public Lighting and Traffic Safety of the IES Committee on Street and Highway Lighting presented by Richard E. Simpson, Chairman, on September 24, 1941, at the IES annual convention, Atlanta, Georgia.

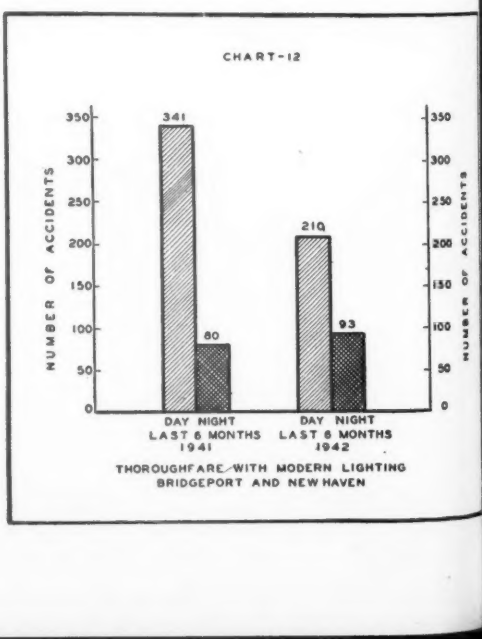
(8) Alleyn H. Beamish, Secretary, the State and Highway Lighting Safety Bureau, 155 E. 44th Street, New York, N. Y.

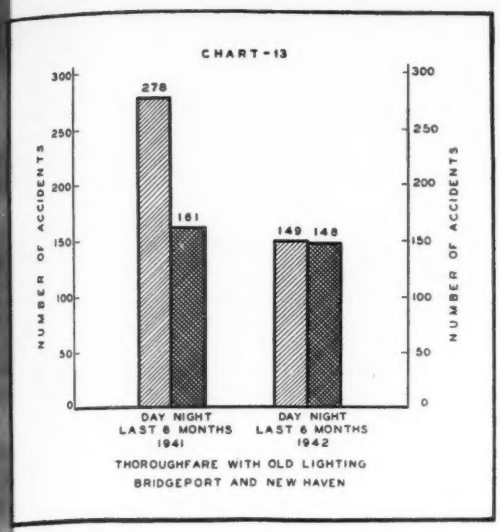
(9) It may be that the purpose of the brown-out is to so modify the dim-out as to eliminate the bad effects. However, since our experience is limited to the dim-out, we must use that, with necessary qualifications, in forming our judgment.

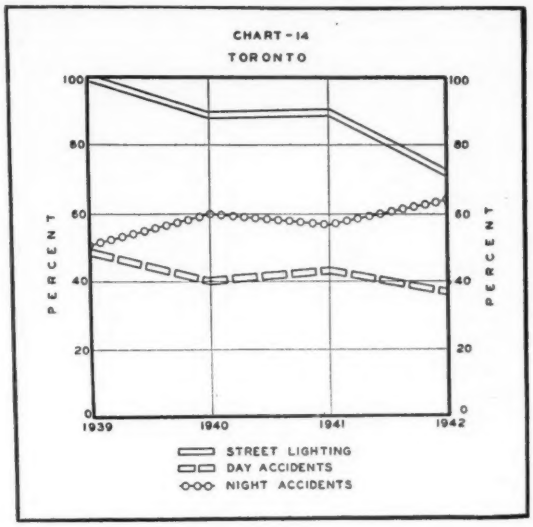


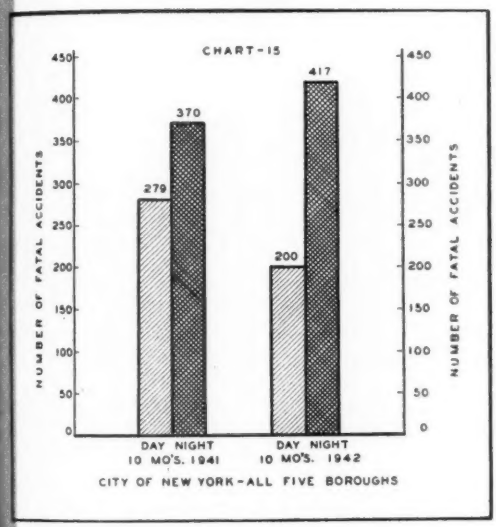


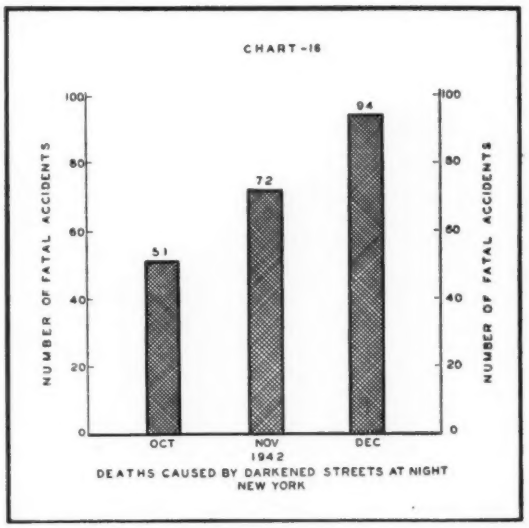












ving represents a drop of 131 accidents or 38 per cent. If same percentage drop had occurred in the night accidents, e would have been 49 accidents, whereas there were ac-lly 93.[10]

Chart 13 gives a similar study on thoroughfares with old ting. Here the reduction in the day accidents was 129, 6 per cent. With a proportionate reduction, the night cidents would have been 87, whereas they were 148.

It is interesting to note in Charts 12 and 13 the greater portion of night accidents compared to day accidents re the old lighting was still in use.

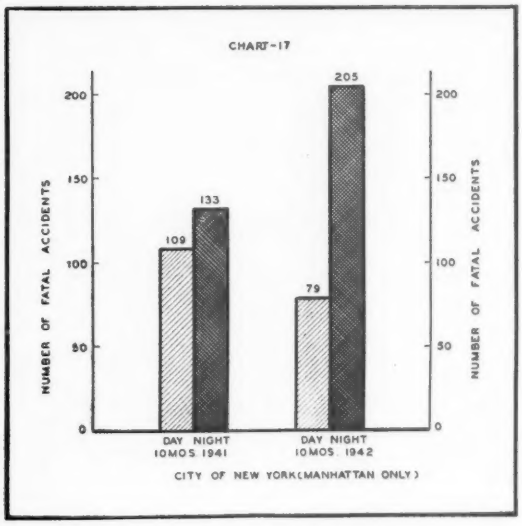
The Toronto experience is shown in *Chart 14*. Taking 39 street lighting intensity as 100 per cent, it is seen the idents were about equally divided, 50 per cent in the day-time and 50 per cent at night. As the lighting intensity was reduced, the per cent of accidents occurring at night increased until in 1942 with the lighting intensity at 72 per cent, 63 per cent of the accident were at night and 37 per cent in the daytime.[11]

The record of New York (all five boroughs) before and after the dim-out is shown in *Chart 15*. The study compares the period of February through November, 1941, with the same period of 1942. The daytime fatal accidents dropped 79, or 28.3 per cent. If the same percentage drop had occurred in the night fatal accidents, there would have been 266, or 151 less than actual.[12]

Chart 16 shows the increasing fatal accidents in New York caused by the dim-out.[13]

Chart 17 shows the fatal accidents in Manhattan—February through November, 1941, compared with the same period of 1942. The daytime fatal accidents dropped 27.5 per cent. If this same percentage drop had prevailed at night there would have been 98, or 107 fewer deaths in Manhattan alone.[14]

"Wartime Dim-outs vs. Public Safety" by Richard E. Simpson, State se Council, Hartford, Conn., presented at the Defense Lighting rence of the American Institute Engineers, New York, January 25, 1943.
Toronto Globe and Mail, January 15, 1943.
Based on State of New York, Bureau of Motor Vehicle figures.
Chief City Magistrate Henry N. Curran (New York) *New York Times*, ry 28, 1943.
Based on State of New York, Bureau of Motor Vehicle figures.



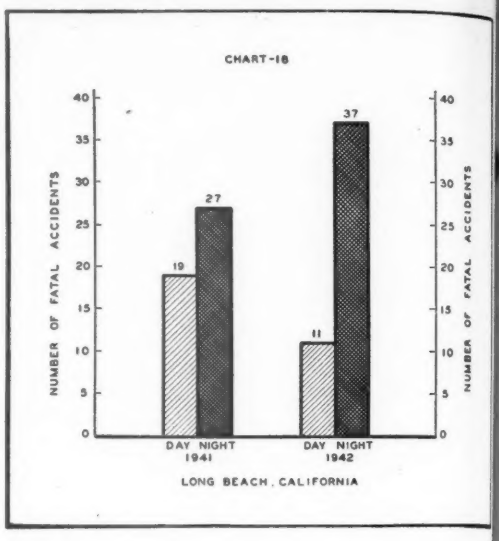


Chart 18 shows a West Coast city, Long Beach, California, where the results are substantially the same.[15]

Suppose Dim-out Is Extended

Although all of the studies so far made indicate that a substantial increase in traffic accidents follows the dim-out, the data are not yet sufficiently adequate to enable an accurate prediction to be made of what might happen if the dim-out or some modification of it were extended to the whole country. And it is not certain that all the existing data have been used in the preparation of this paper although information was gathered from many agencies, all of which have been most generous.

However, with the information at hand, it is possible at least to obtain a very rough idea of what might be expected. Probably more information will become available within the next few months to enable a more nearly accurate prediction to be made.

Let us examine the "before and after dim-out" results shown in Charts 12, 13, 15 and 18 covering the studies in Bridgeport, New Haven, New York and Long Beach. The results of the calculations shown in *Table 1* are presented in *Chart 19*.

Let us take a conservative view of these figures and assume the increase in accidents caused by the dim-out will be 25 per cent instead of 46 per cent of the night accidents that occurred before the dim-out and before curtailment in car driving.

In 1942 there were 16,700 fatal automobile traffic accidents occurring at night, 11,000 of which were to workers.[16] Applying the 25 per cent factor, we get an increase of 2,750 fatal accidents among workers per year which might be expected if the dim-out were extended to a national basis.

Assuming a man works 48 hours a week for 50 weeks a year, we have 2400 man-hours of work per year. The death of 2750 workers a year means the loss of 13,200,000 man-hours a year.

On the average, there may be expected 36 non-fatal accidents for each fatal accident.[16] Consequently, we m expect an increase of 99,000 non-fatal accidents am workers per year caused by a national dim-out.

There are 360 man-hours lost, on the average, in c non-fatal accident.[16] This accounts for 35,200,000 m hours lost per year from non-fatal accidents.

Adding these annual losses, we have:

Loss from increased fatal accidents.....13,200,000 man-hours l
Loss from increased non-fatal accidents.35,200,000 man-hours l

Total increased loss .....48,400,000 man-hours l

which might be expected from a national dim-out.

This does not take into account the man-hours in hosp and all other man-hours lost indirectly through such a dents.

TABLE I—COMPARISON OF STREET ACCIDENTS IN F CITIES—BEFORE AND AFTER DIM-OUT REGULATIO

	Before		After		Change		B—% Decrease Day	A-BA—After Night Record if day % dec. had prevailed	Increase Due to Dim-out
	Day	A—Night	Day	Night	Day	C—Night			
Bridgeport and New Haven (Modern Lighting) (1)	341	80	210	93	−131	+13	38.4	49.3	43.7
Bridgeport and New Haven (Old Lighting) (1)	278	161	149	148	−129	−13	46.5	86.2	61.8
New York 5 Boroughs (2)	279	370	200	417	−79	+47	28.3	265.0	152
Long Beach, California (2)	19	27	11	37	− 8	+10	42	15.7	21.3
Weighted Average	—	—	—	—	—	—	—	—	—

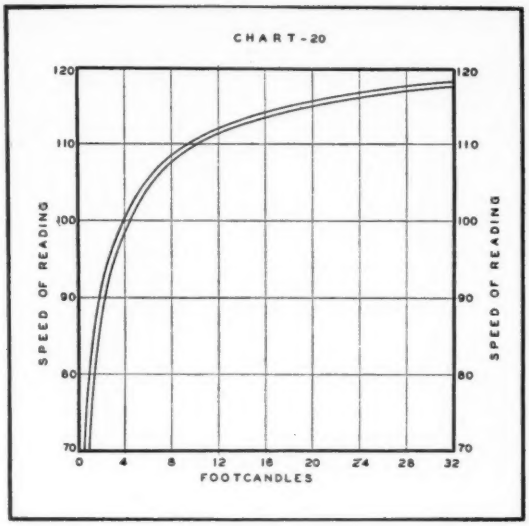
(1)—All accidents. (2)—Fatal accidents.

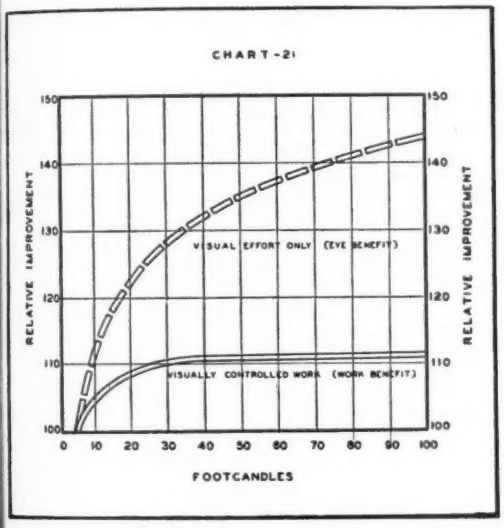
[15] From Mr. Alleyn H. Beamish, Secretary of the Street and Highway Lighting Safety Bureau, who has recently sent a questionnaire to West Coast and East Coast communities to study the effect of the dim-out on traffic accidents.

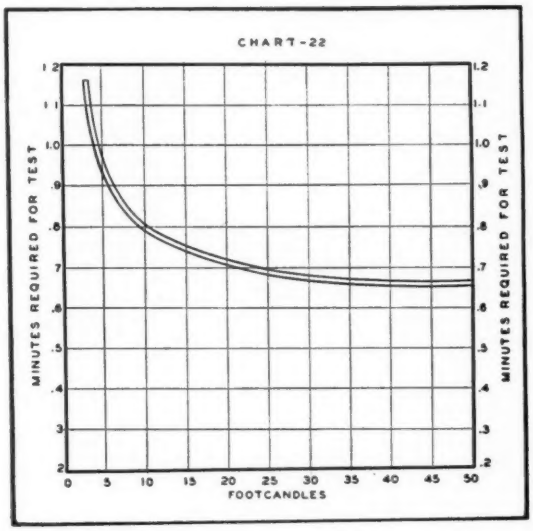
[16] National Safety Council, Inc.

CHART-19

	INCREASED ACCIDENTS DUE TO DIM-OUT EXPRESSED AS A % OF NIGHT ACCIDENTS OCCURRING BEFORE THE DIM-OUT
BRIDGEPORT & NEW HAVEN (MODERN LIGHTING)	54.6%
BRIDGEPORT & NEW HAVEN (OLD LIGHTING)	38.4%
NEW YORK (5 BOROUGHS)	41.0%
LONG BEACH	78.8%







This increased loss of 48,400,000 man-hours a year is to be compared with the saving 4,000,000 man-hours a year previously referred to in the fuel conservation.

This then is a brief of the studies on lighting and safety relating to one of the largest groups of accidents—those caused by automobiles and at night. The various cities, states and agencies keeping a detailed record of these accidents are to be congratulated for they are making an immeasurable contribution to the war effort, not only by saving valuable lives and man-hours themselves but by pointing to methods others may follow.

But there is need for more data and more studies that all may now afford because of the unusual value of every man-hour in helping to win the war.

Lighting and Increased Production

There is a wealth of information available that demonstrates the increased production resulting from improved lighting. However, there is such a close relationship between lighting and production, and lighting and safety (that which primarily holds our attention at the moment) that it is difficult to separate them. Tests indicate that improved lighting betters visibility, increases accuracy, lessens fatigue, all of which result in an increase in production and a decrease in accidents—and the decrease in accidents in turn causes a further increase in production.

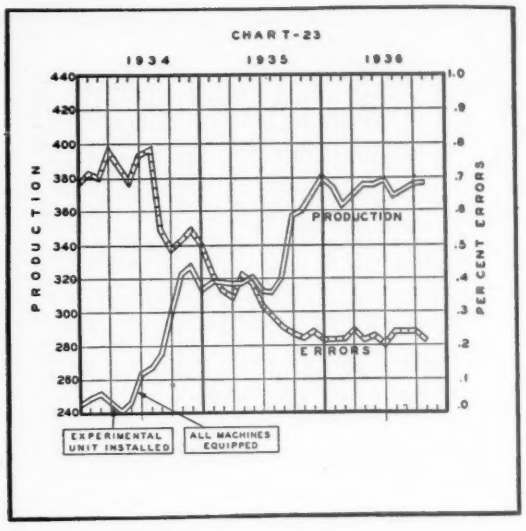
Many of these facts are generally familiar to most of us, but the value of man-hours has assumed such an increased importance that it is well that we pause for a moment to review some of the fundamentals.

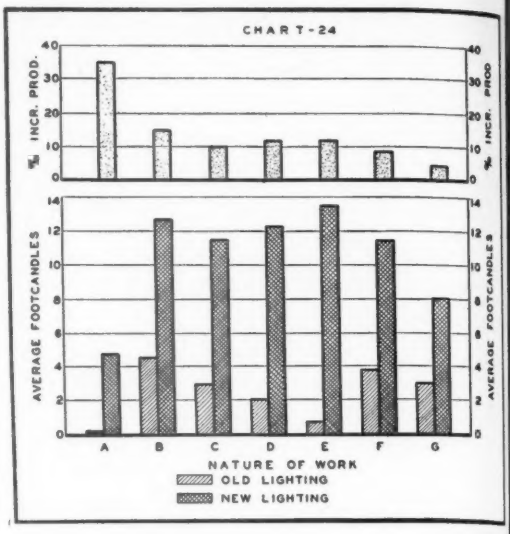
Probably the most scientific and complete studies of this relationship were made by Dr. Matthew Luckiesh, Director, Lighting Research Laboratory, General Electric Company at Nela Park, Cleveland, Ohio.[17]

Let us review a few of the findings. *Chart 20* shows the effect of level of illumination on the speed of reading.

The lower curve in *Chart 21* summarizes the results of several investigations involving the performance of various

[17] "The Science of Seeing" by Matthew Luckiesh, D.Sc., D.E. and Frank K. Moss, E. E.





tasks guided by vision. The upper curve summarizes the results of several investigations involving only visual recognition of test objects. It is significant that benefit to seeing persists above the level of illumination at which work benefit ceases to increase.

Since speed of production is now so important, *Chart 22* is significant in showing the time required to perform the Luckiesh-Moss Visual Test correlated with level of illumination.

Chart 23 shows the increase in production and the decrease in errors, respectively, which followed the installation of supplementary lighting units upon business machines.

Chart 24 shows a few typical examples of increase in production resulting from Increased Illumination.

These are:

A. Pulley finishing.
B. Soft metal bearings.
C. Heavy steel machinery.
D. Carburetor assembly.
E. Electric and gas iron manufacturing.
F. Semi-automatic buffing shell-sockets.
G. Lathe sorting.

Improved lighting resulted in an average increase in production of about 12 per cent.

Although lighting probably was an important factor in the 18,500 deaths and the 1,300,000 injuries from 1942 occupational accidents, it is not known to what extent. The[re] are so many factors affecting safety that it is difficult [to] determine just what part of these accidents can be attribute[d] directly to lighting.

However, sufficient data could be made available to e[n]able us to make a good approximation. For example, su[p]pose a study were made of 100 or even 1000 cases of indu[s]trial plants where complete lighting rehabilitation had be[en] made. Records could be obtained of *all* accidents for o[ne] year before and one year after the lighting improvement. [A] chart could then be prepared showing the correlation betwe[en] per cent change in footcandles and per cent change in acc[i]dents.

Conclusion

These are the facts as have been determined from researc[h]. There obviously is need for further study along this line [so] that better and more nearly complete information can [be] made available. Once the authorities have this informati[on] before them, they can act intelligently on it with the res[ult] that our war effort will be furthered and the day of bringi[ng] the Axis to defeat will be that much nearer. It is the respo[n]sibility of business management to continue to determine t[he] facts and to make them available to the authorities so wi[se] decisions can be made. When these decisions are made, t[he] American people will co-operate to the fullest extent in c[ar]rying them out. That is the way Americans do things.

APPENDIX—WARTIME LIGHTING AND SAFETY

Organizations and publications from which data and information were obtained.

Organizations

Better Light Better Sight Bureau, 420 Lexington Avenue, New York, N. Y.

The Bureau of Safety, 20 North Wacker Drive, Chicago, Ill.

Edison Electric Institute, 420 Lexington Avenue, New York, N. Y.

Illuminating Engineering Society, 51 Madison Avenue, New York, N. Y.

General Electric Company, Nela Park, Cleveland, Ohio.

Greater Chicago Safety Council, 222 West North Bank Ave., Chicago, Ill. George G. Traver, Manager.

National Safety Council, Inc., 20 North Wacker Drive, Chicago, Ill.

National Society for the Prevention of Blindness, Inc., 1790 Broadway, New York, N. Y.

Street and Highway Lighting Safety Bureau, 155 E. 44th [St.] New York, N. Y.

Westinghouse Electric and Manufacturing Co., Bloomfield, N.

Publications

"Public Safety in Detroit as Affected by Street Lighting" by L. Schrenk, General Superintendent. Public Lighting Commission, D[e]troit, Mich. A paper presented before the 35th Annual Convent[ion] of the Illuminating Engineering Society, Atlanta, Ga., Septem[ber] 22 - 25, 1941.

"Traffic Safety Lighting" — a report of the Subcommittee [on] Recommended Practices of Street and Highway Lighting to [the] Committee on Street and Highway Lighting of the Illuminat[ing] Engineering Society, June 8, 1939. Report presented by L. A.

Wood, Chairman of the Subcommittee and Chief Lighting Engineer, Westinghouse Electric and Manufacturing Co.

"The Science of Seeing" — by Matthew Luckiesh, D.Sc., D.E., Director, Lighting Research Laboratory, General Electric Company, Nela Park, Cleveland, and Frank K. Moss, E.E., Physicist, Lighting Research Laboratory.

"If Illumination Saves Only One Life — It Has Paid for Itself" by F. Lynden Smith, Director, Department of Public Works and Buildings, State of Illinois. Printed in the interests of highway safety. Greater Chicago Safety Council.

"Public Safety Magazine," January and July, 1942, issues. Published by National Safety Council, Inc.

"Eyesight in Industry, a Note to Industrial Executives." N.S.P.B. No. 373.

"Illumination and Eyesight in Industry" by LeGrand Hardy, M.D., Director of Eye Service, Fifth Avenue Hospital, New York, N. Y. N.S.P.B. No. 97.

"The New Concept of Visual Performance in Industry" by Hedwig S. Kuhn, M.D., Hammond, Indiana. N.S.P.B. No. 340.

"Industrial Eyesight in War — in Peace" by Charles P. Tolman, New York Consulting Engineer for the National Society for the Prevention of Blindness, Inc. International Labor Office, Montreal, 1942.

"Evidence About Your Fatal Streets!"—Street and Highway Lighting Safety Bureau, 155 E. 44th Street, New York, N. Y.

"Dark Hour" — Accident Experiences Survey by R. E. Simpson.

"Darkness for Victory — Electric Utilities' Role in Curtailment of Power for Black-outs, Dim-outs and Other Defense Measures" by T. P. Walker, President, Council of Electric Operating Companies—an address at the conference symposium on Defense Lighting for the National Technical meeting of the American Institute of Electrical Engineers, held at New York City, January 26, 1943.

"Night Safety Bought Cheaply" by Richard E. Simpson—a Report of the Subcommittee on Public Lighting and Traffic Safety of the I.E.S. Committee on Street and Highway Lighting, September 24, 1941, at the I.E.S. Annual Convention, Atlanta, Georgia.

"Oh Say Can You See" — A detailed report on New Jersey statewide "Safety Lighting Program" by E. R. Sherbaum, New Jersey State Highway Department.

"Highway Lighting for Safety" by Robert H. Warren. *Public Service Magazine.*

"Black-outs" — United States Office of Civilian Defense, Washington, D. C.

"Traffic Fatality Analysis City of Los Angeles 1939." State Traffic Engineering Bureau, Los Angeles Police Department, R. T. Dorsey, Traffic Engineer.

"The Travelers 1942 Book of Street and Highway Accident Data" — Travelers Insurance Company.

"Plant Efficiency" — Ideas and Suggestions for Increasing Efficiency in Smaller Plants — War Production Board, issued by Division of Information, Washington, D. C.

"War Department Specification Black-out Requirements for Highway Movement" — United States Office of Civilian Defense, Washington, D. C.

"Wartime Dim-out and Public Safety" by R. E. Simpson, State Defense Council, Hartford, Conn., presented at the Defense Lighting Conference of the American Institute of Electrical Engineers, January 21, 1943.

"Where There Is No Vision" — Article by Charles Edison, Governor of New Jersey. Reprinted from *New Jersey Municipalities,* May, 1942, and distributed by the Safety Committee of the New Jersey League of Municipalities.

Federal Power Commission Trial Examiner Rules Out Rate Comparisons as Measure of Reasonableness

IN view of the fact that Federal Power Commission has emphasized comparability of rates in its publications and public utterances as being somewhat of a measure of reasonableness of rates, the attitude of the Commission in the recent Southwest Power Pool Hearing held at Little Rock, Arkansas, is of considerable interest.

At the outset of the Southwest Power Pool Hearing the electric companies offered a comparison of the pool rate charged Defense Plant Corporation and the rate charged the same customer for identically the same type of service by Ark-La Electric Cooperative, Inc., an R.E.A. financed organization delivering Grand River power and energy over its 200 mile transmission line built expressly for serving the aluminum plant at Lake Catherine, Arkansas. Such a comparison was immediately ruled out by Chief Trial Examiner Frank A. Hampton and was not admitted as evidence. Repeated attempts met with the same result. Finally, the Arkansas Department of Public Utilities, in its intervention, attempted to show that when the rate of the ten companies was filed with the Department, it determined its reasonableness by comparing it with the rate of the Ark-La Cooperative. In so doing, Judge Lasley, Counsel for the Department, said, "the Department was following the suggestion that the Honorable Leland Olds, Chairman of the Federal Power Commission, made in a public address at Santa Fe, New Mexico, on September 8 or 9, 1941, to the effect that an efficient way of measuring the reasonableness of rates of private companies was a comparison of its rates with publicly owned or financed agencies."

Evidence showing this comparison was ruled out in spite of Mr. Olds' statement. The Chief Trial Examiner in ruling it out said:

". . . the matter of the reasonableness and fairness of the rates, charges and arrangements embraced within the contract that we are here investigating, (is) to be determined upon the facts of this case . . .

"The fairness or unfairness, reasonableness or unreasonableness of rates, is not, as a matter of law in rate proceedings, determined in any such fashion as (by comparisons) . . .

". . . to make any comparison of evidentiary value, comparability of material and essential conditions would have to be shown all along the line, otherwise the comparison would mean nothing. . . . What would that mean? It would mean we would first have to enter upon a preliminary trial on the question of comparability. We woud have to try first the question of comparability and make a determination as to whether or not the conditions were so substantially comparable as to make the evidence . . . of any evidentiary value, and then after we did that there would be nothing to prevent you (r) coming forward and wishing to make another comparison with another point and with another, and with another, and with another, advancing reasons just as sound as your first comparison.

"You could scarcely find two companies where all the material factors and the conditions were substantially similar as to make a mere comparison of rates of any substantial evidentiary value. Each case ought to be determined fairly and correctly on its own facts, its own costs, its own operations, its own facilities, and it would not support or condemn a rate charged by one company to show that a similar rate, or one higher or one lower, was charged by another company."

Nightmare for Hitler and Company

WITH the theme, "Nightmare for Hitler, Tojo and Mussolini," a recent advertisement of the Hartford Steam Boiler Inspection and Insurance Company, emphasizes that *American electric power* "is one of the things keeping Hitler and his gang awake nights . . . thanks to the foresight and initiative of the men who operate the electric utilities."

Utilities' Problem of Taxes Growing

Federal Levies Alone in 1942 Exceeded Industry's Payroll—Up 35% in Year

By Thomas P. Swift
New York Times Financial Writer

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FOR the first time in the sixty-year history of the public-utility industry, the Federal Government alone in 1942 took a greater percentage out of the gross revenue received by the utilities than the utility worker earned as his share in producing the nation's electric light and power supply.

The tax problem has been one of increasing concern to the utility industry for several years, particularly in view of the fact that utility rates have continued their downward trend while the costs of other items of living have increased. Since the outbreak of the war in Europe, and the start of our national defense program, the cost of virtually all essential commodities has edged steadily forward, but the cost of electric power, on a national average basis, has been lowered to the point where rates are currently the lowest in the history of the industry.

Investors' Returns Cut

Management has wrestled with the tax problem for many years. Investors have witnessed their margins of return dwindle almost in direct proportion to increased tax costs, but now the problem appears to have passed from that stage into one of greater social and economic implication. The hundreds of thousands of utility workers throughout the nation last year received less for their efforts than the Federal Government exacted in taxes—and the electric power and light industry stands high on the list of industries with favorable wage scales.

A breakdown of operating results of the private power and light industry for 1942 discloses that payrolls aggregated $368,000,000, an increase of only $4,000,000 over 1941. This somewhat small increase is accounted for by the reduction in the number of employees brought about by the operation of the draft for armed service, since wages on the whole were better last year than in 1941. On the other hand, the Federal Government, through its various classifications of taxes on utility operation, took $400,000,000 from the industry last year, an increase of $105,000,000, or 35.5 per cent, over 1941.

Although Federal taxes constitute by far the largest item of tax expense in utility operation, State and local taxes also swell tax accruals on utility properties. Last year all such taxes paid by the electric power industry aggregated $628,000,000. This was equivalent to 24 cents out of every dollar of gross revenue taken in by the industry, and compares with an over-all tax of 6½ cents out of every dollar paid during the last war in 1917.

Over-all taxes on the nation's electric companies last year constituted the second largest item in the cost of operation, being exceeded only by the cost of fuel, materials and supplies, which in the aggregate totaled $645,000,000, compared with $586,000,000 the year before. The investor in utility common stocks, on the other hand, received only $268,000,000 in dividends last year, a drop of 15 per cent from the income he realized in 1941.

Since gross revenues of the industry for 1942 ran to an estimated $2,625,000,000, the worker's share of $368,000,000 constituted 14 cents out of every dollar of revenue. Direct Federal taxes, aggregating $400,000,000, took 15 cents out of every dollar, and with all taxes taken into account this figure moves up to 24 cents. Unlike most other industries, however, the utilities have been unable to adjust their rates upward to meet the increased costs of taxation, [illegible] and supplies.

Trends of Rates and Taxes

By way of illustration of this proc[illegible] average residential rates for elec[illegible] power in 1917 were 7.52 cents a ki[illegible] watt-hour; in 1933 the rate had decli[illegible] to 5.52 cents, and in 1942 it was 3.[illegible] cents, an over-all drop of 52 per cent. [illegible] sharp contrast, taxes in 1917 took [illegible] cents out of every revenue dollar; [illegible] 1933 taxes took 13 cents, and last ye[illegible] 24 cents, an over-all increase of 270 p[illegible] cent.

While the end of the tax probl[illegible] appears to be nowhere in sight, uti[illegible] managements are becoming more o[illegible] spoken on the subject. In his annual re[illegible] port to stockholders last week, Edwa[illegible] L. Shea, president of the North Am[illegible] ican Company, took occasion to make [illegible] following observation:

"It seems only fair to remark that [illegible] this period of national stress, when c[illegible] porations and individuals in every li[illegible] of endeavor are bearing the burden [illegible] heavy governmental expenditures a[illegible] the taxes of investor-owned utilities a[illegible] increasing all out of proportion to i[illegible] creases in their revenues, governmen[illegible] and municipal utilities are still not p[illegible] ing a cent in Federal taxes and w[illegible] some exceptions are paying no State [illegible] local taxes."

Payments to Labor and to Government by the Electric Light and Power Industry

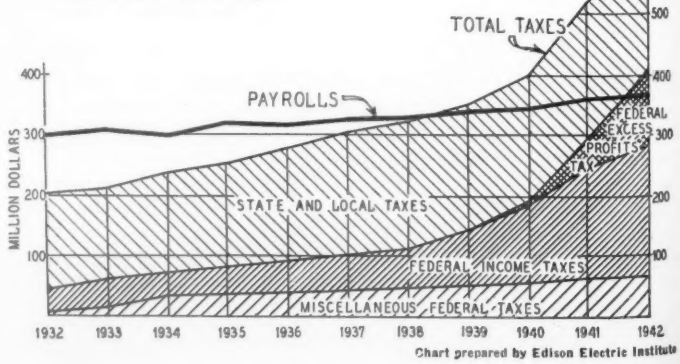


Chart prepared by Edison Electric Institute

Utilities Work for Victory

By C. E. Greenwood
Commercial Director, Edison Electric Institute

IN supporting the greatest war effort in the history of the world with fighting man-power, with food and mechanical equipment, Government has launched one program following another affecting the civilian population. Included in the millions of people concerned are the approximately twenty-eight million residence customers of the electric utilities in urban and rural communities; four and one-quarter million commercial, and another hundred and fifty thousand in the industrial classifications. These do not include the twenty-five thousand municipalities with street lighting contracts and one hundred thousand other customers.

Quite naturally the utilities throughout the nation can serve best as informational media for these Government activities, and act as mainsprings in local community tie-ins. They are in the front rank of industries closely coordinating in forwarding emergency measures essential in this colossal struggle for our national existence.

There can be a no more effective group to carry forward information and to assist in different phases of the all-out wartime program.

Fortunately the confusion in computation of power requirements for the major production effort of all times has been clarified. Bickerings over potential power needs between those factually inclined and those politically minded are at present state of calm. Public confidence may result from a statement of C. W. Kellogg, President of the Institute, before a meeting of Western Massachusetts Engineering Society, when he said:

"Contrasted with the conditions surrounding many basic materials, which have had to be severely rationed due to there being not enough to go around, there was no rationing of electricity and no shortage of it. This showing was made in the face of the greatest industrial war effort ever put forth by any country."

And no greater assurance can be given by those in Government circles who are skeptical, than the statement of the capable Director of the Office of War Utilities, Mr. J. A. Krug, in his address before the TVA Distributors at Chattanooga, Tennessee. Mr. Krug said:

"The power men — public and private, in this area and throughout the country—should be proud of the job that has been done in providing power supply. Power has never been 'too little or too late.' There is today no shortage of power. This is in sharp contrast to the situation as to many other vital necessities. I do not know of a single instance in which the operation of a war plant has been delayed by lack of electric power supply."

This condition has been made possible by a spirit to help within economic limitations and beyond. Management asks no praise. It is the duty of all companies as citizens.

Then there are other cooperative activities beyond the engineering problems of power supply where relationship between utility and consumer is lending invaluable aid in Victory efforts. In previous articles in the pages of the BULLETIN, there have been reviewed utility participation in the original tool surveys throughout industrial plants of the nation, and also assistance given in organizing throughout our industry, the national Salvage and Scrap campaigns. Thousands of tons of critical material resulted from the latter. There were twelve million pounds of copper alone supplied by the electric utilities in 1942 and it is now estimated that ten million pounds will follow in 1943. But the end is not yet.

New Opportunities for Scrap

There is a continuous demand for more copper, more brass, more nickel and men in the Industrial Conservation Division of WPB have in mind two other possible fields of investigation. The

YOUR PLACE
TO BE AN OFFICIAL
SALVAGE DEPOT
for
OLD LAMP BULB BASES

SALVAGE OF SCRAP METAL - You appreciate the pressing need for salvaging every possible bit of scrap metal - and here's a way you can help by acting as a collection depot for metal that is normally thrown away. Every incandescent lamp bulb base contains recoverable metal. Each one has only a little, but collectively they represent a source of many pounds of vital brass and nickel. The Salvage Conservation Division ction Board has requested the cooperation of all who handle electric articipate in salvaging lamp bulb bases - and also fuses.

art in the plan is easy. All that's required is to provide a ch the public may place their old lamp bulbs or bases alone, which- ing in. The salvage material is turned over to your regular source lamp bulbs.

E CONTAINER - A good heavy corrugated box can be used for collection m a carton in which you received a supply of new lamp bulbs or . A wooden box of proper size might also be used or even a barrel. The top of the container should be entirely removed so that the n be easily dropped in. The size of the box can be approximately 5 inches wide and 18 inches deep. An attractive red, white and blue "Official Salvage Depot for Old Bulb Bases", will be furnished free ched to the side of the container. LOCATION - Place the receiving it will be readily accessible to everyone. If you sell new lamp be located beside your electric lamp bulb display.

- The scrap metal is to be turned over at regular intervals to pply for new lamp bulbs. This may be your own warehouse, wholesaler, ealer, etc. If your lamp bulb salvage has not been collected by tainer is filled, call the Indianapolis Power & Light Company. Phone n 332 and arrangements will be made for pick-up. The Diamond Chain Company then will tumble the bases, separate and recover the salvage, ily of high-grade brass and 99.2% nickel wire. All cash proceeds cal U.S.O.

e will be well informed about the lamp bulb drive through an er and radio campaign. They will be advised of the urgent war need mp bulb bases and instructed to take them to a location like yours be salvaged. YOUR AID in making this metal salvage drive a success war and be greatly appreciated by the sponsors and the government.

mpany-Indianapolis Power & Light Company

Needed for War
Save
YOUR OLD
LIGHT BULB BASES
for
METAL SALVAGE

Don't throw away your old burned out Electric light bulbs and fuses. Save them for a special salvage campaign to start soon in Indianapolis. War demands every bit of scrap metal and now Uncle Sam wants this particular metal that heretofore has been thrown away. You will be advised later how to dispose of your old lamp bulb bases—but in the meantime be sure they're saved.

Salvage depots will be established and collections will be supervised by the Indianapolis Power & Light Company. Then the DIAMOND CHAIN AND MANUFACTURING COMPANY will separate and recover the high-grade brass and 99.2% nickel wire. All cash proceeds will go to the U. S. O.—the vital metal to help lick the Axis. Start saving today.

ALL PROCEEDS GO TO THE U. S. O.

This message approved by John P. Collett, Indiana Director Industrial Salvage Branch Conservation Division
WAR PRODUCTION BOARD

INDIANAPOLIS *Power & Light* COMPANY

These striking messages are seen on many highways

first is metal salvage from light bulb bases. There were over seven hundred million lamp bulbs sold in the U.S.A. last year. There are millions more in homes. The lamp bases more recently manufactured are made with steel, brass plated, but all the older lamps have solid brass screw bases. One large operating utility with free renewal provisions in the service rate sent one million sixty-watt lamps to the mill for tumbling, from which were recovered seventy-three hundred pounds of brass, one hundred and thirty pounds of nickel, and thirty pounds of valuable tungsten. This is indicative of the possibilities.

The industrial conservation authorities have in mind a national program in which electrical consumers will help by saving burned out light bulbs and fuses for such metal recovery. The Indianapolis Power and Light Company, one of the earliest in the line-up, has started an advertising program among electrical consumers to bring in these bases both in standard and Mogul sizes. One of the interesting advertisements is illustrated here.

Another proposal for utility coordination now under advisement is the collection of critical scrap through means of gathering appliance equipment in the outmoded class and inoperative. It is estimated there are substantial amounts of metal represented in the small appliance group which is in home storage. There are vital parts of these appliances which could be salvaged, and which might be used in the maintenance of the more modern equipment. Moreover, the shells of the irons, toasters, hollow-ware, the old vacuum cleaners and tools, and other parts discarded, will add much desired scrap in the critical materials list.

Of course, there must be some slight incentive besides patriotism to induce owners to part with even these old-time friends. The number available has been reduced no doubt, as scarcity made replacements impossible, and result many thousands being overhauled placed into operation during the gency.

It has been suggested that arr ment be made to offer certificat given value for each appliance turn this amount to represent a credit similar device purchased in the p time period. The duo-advantages gained merit careful weighing o proposal.

Food and Nutrition

To organizations like the el utilities that had been promoting advantages of electrical cooking for eral years, with its related vitamin tors, the food and nutrition prog that became essential in the war e were "naturals" for intensified pr tion. Since "food will win the war," message of food conservation, and tive eating habits to adjust to nat rationing is traveling the highway byways through Home Service De ments of our operating companies.

For example, Georgia Power pany home service supervisors are trict supervisors of county nutrition mittees for 31 counties in the state home economists of the company a the state committee or head up c county committees.

In 1942 Georgia Power Com home economists discussed nutrition

Victory Garden Display in a Georgia Power Company office

Following the Receding Frost Line Victory Garden Advertisements appear First in Southern Communities.

PLANT THE SEEDS OF Victory
IN YOUR OWN BACKYARD
More food is needed everywhere — for our fighters, our workers, as a weapon of invasion, to keep our allies fighting. In spite of three years of record breaking farm production, demand for food is increasing faster than production.
Food for our fighters and their allies comes first! Every little garden plot in America releases needed food for a vital purpose, and helps close the gap between supply and demand of the most essential war product of them all.
Shortage of canned foods—The present shortage of canned foods is placing a far too heavy demand on grocer's fresh foods. During the winter season the grocer's fresh foods will need more help than ever . . . in the form of foods grown at home and canned at home the previous summer.
A word to the wise . . . a Victory Garden makes good war time sense. It enables you to write your own food rationing ticket, and assure your family an abundant supply of fresh and home canned foods the year round.
Patriotism and pleasure—A lot of people are going to find that growing their own vegetables is a lot of fun, providing healthful outdoor exercise and patriotic satisfaction as well as essential food. Uncle Sam is asking his nephews and nieces to plant more Victory Gardens and to put up in jars all vegetables and foods they have hitherto bought in cans.
Remember – South Texas Victory Gardeners are favored with a climate that permits vegetable growing the year 'round.
HOUSTON LIGHTING & POWER COMPANY

304 customers in their homes, the company has distributed 100,000 pieces of literature nutrition. Lecture demonstrations on some phase of nutrition given 1,560 times, with audiences totaling 53,116. Such lecture demonstrations consisted of Red Cross nutrition classes, canning classes, short courses, and nutrition information tied in with other phases of homemaking.

The call for women in Red Cross, Auxiliary Forces, and other direct war work, together with the necessary curtailment in commercial budgets, has taken its toll of the women in our industry engaged in this work. But the remaining forces are carrying on at top speed in assisting public adjustment to food supply. Instructors are being furnished to Women's Clubs for Nutrition classes, and to Red Cross workers for canteen duties. The conservation of foods that are available for family use is an important phase of coordinated activities with the Government. Food supplies in the home must be stretched to the limit and wastage cut to a minimum.

Said former President Hoover in his recent speech before the Mid-West Governors Conference: "A weakened home front will weaken the military front." In connection, Mr. Hoover quoted President Wilson in his pronouncement that "the men and women who devote themselves to these things will be serving the country and conducting the fight for peace and freedom as truly as the men on the battlefield." Without question, he was thinking of the entire problem of food production and the feeding of the civilian population as well as the armed forces. Here again, commercial departments of utilities have been effectively active within the restrictions surrounding the supply of farm equipment, to help on the food production front. The farmer needs help along lines of maintenance of the equipment he now owns.

There have been booklets produced by several utilities for the benefit of their rural consumers as guides for care and repair of their motors and wiring. The Electic Water Systems Council, in which Edison Institute participates with the Pump Manufacturers Association, is publishing a Manual which will be timely and helpful to the farmer in his maintenance problems. A cry for food for the millions here and in Allied Nations has high-lighted the farmer as a key man in winning the war.

Victory Gardens

The doctrine that "the Lord helps those who help themselves" is a thought to be reckoned with in food supply. The person who will seriously cultivate a vegetable garden of his own, applying home labor, is not only helping himself but he also contributes his bit to the general Victory Program directed to the goal of 18,000,000 such gardens. The first World War taught us the potential possibilities in such activities.

Once again Government urges everyone who has suitable space to make the home vegetable garden a family project. The utilities are getting set to help carry the ball. In fact, there are many companies now playing the game and plans indicate splendid assistance toward the goal of national stimulation of this Program.

Publicity of all classes is being given to it now, or is being prepared, in hundreds of communities. Certain companies are displaying outdoor posters and following up with newspaper advertising to stimulate public interest. Still other com-

panies are equipping their showrooms with Victory Garden displays. For example, the Pacific Gas and Electric Company is supplying one hundred offices with the Victory Garden window display, 4 ft x 6 ft in size. These backgrounds will be made realistic with garden tools, accessories from local dealers. Special instruction pieces prepared by the University of California will be furnished. Floor people will use these in answering inquiries. This same company is following this general arrangement with a special display on home chicken-raising. Georgia Power has a similar program.

The Tampa Electric Company advertised a Victory Garden display in its LEISURE HOUSE headquarters and more than seven hundred and fifty people responded the day following to obtain information on planting one of their own. Boston Edison forms its own Victory Garden Committee for activity among the employees.

In Iowa, the heart of the farm belt, Des Moines Electric Light Company turned over part of the area formerly occupied by its appliance display for a Garden Center. A practical, small garden 16 ft x 28 ft is in the making, and because the store is air conditioned, lighting is expected to insure healthy growth of plants. Here will be also a center of information and advice to the public and a meeting place for Garden Clubs, Red Cross agencies and others trying to solve food problems. Iowa State College Extension Service is cooperating in furnishing printed instructive material.

It would appear that GARDENS FOR VICTORY is off to a strong start, and such coordination with this war-time program will gain praiseworthy results in good-will of more than the customer group.

War Bond Promotion

Many of the same utility employees who are engaged directly in the nation's all-out war activities are also investing part of their weekly compensation in War Bonds and Stamps. Companies are encouraging such investment within their ranks and also stimulating public interest. And what company is not? A war stupendously expensive must be financed. Stamp Booths in offices and showrooms; War Bonds and Stamps as prizes in numerous contests especially directed to the younger generation; volumes of messages in publicity and advertising, some as general reminders and others devoted to direct appeal, are indicators of effective tie-in.

One of the popular advertising methods adopted is the slogan and design of posters produced by the Modern Kitchen Bureau which interjects a commercial thought. They suggest the investment in War Bonds now as saving for peacetime buying of household needs. As events unfold one is convinced that *Lucky Me!—I'm An American* is more than a slogan. In one city we read these messages on outdoor posters and in others the public sees the memory jog in store displays and on company tru and so through hundreds of communi The people's money must pay for war and more investments in Gov ment securities should mean less in come taxes.

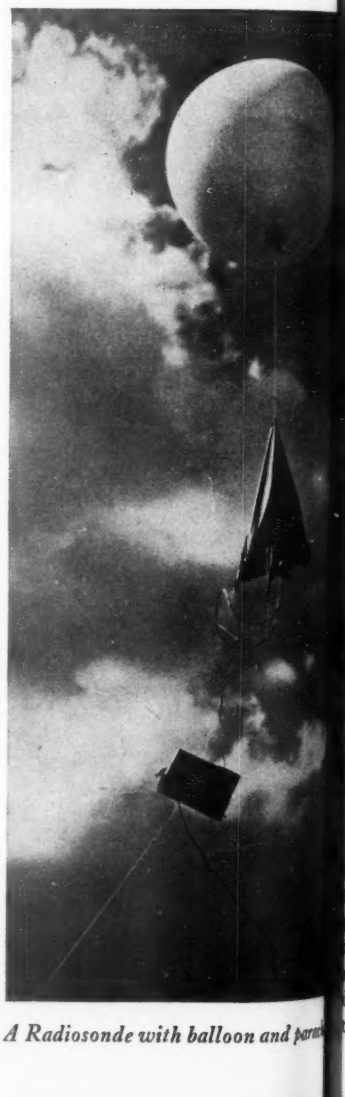
Let the good work of concentrat on winning the war go on. The utili will not lag in their local program carry forward the Government activi directed to shortening the period of life-and-death global struggle.

Radiosondes and High Voltage Lines—a Warning

THE U. S. Weather Bureau reports that a fatal accident occurred recently when a lineman attempted to disengage one of the Bureau's radiosonde balloons from high-tension wires in which it had been entangled in flight. We have been asked by the Weather Bureau to publish a description of the accident as a future safeguard against the risk that proved fatal in this case.

The radiosonde consists of a silvered cardboard box 9 inches square and 4 inches deep, containing apparatus for the automatic radio-transmission of atmospheric pressure, temperature, and humidity. Attached to 6-foot helium-filled balloons, these instruments are released for flight into the upper atmosphere twice a day from about 40 stations located throughout the United States. During flight the radio transmits a continuous record of the temperatures, humidities, and pressures of the air through which the instrument passes; and the signals, recorded by ground receivers, provide the weather forecaster with very valuable information upon the structure and movements of upper-air currents to heights frequently exceeding 10 miles. At these altitudes the balloon bursts and the instrument returns to earth by parachute.

The radiosonde carries an antenna of No. 18 stranded rubber-covered wire extending 3 feet above and below the box. The upper portion is held fairly straight by the pull of the balloon cord to which it is attached; the lower portion, bearing a light lead anchor, swings somewhat in the wind. In the accident reported by the Weather Bureau, the balloon became entangled in the wires a few feet from the cross-arms of a high-tension pole, leaving the radiosonde box swinging free. When the lineman climbed the pole to free the balloon, he apparently touched the lower portion of the ante while the upper portion was in con with the power line at the same mom his foot touched a piece of pipe attac to the pole, completing the contact w the ground.



A Radiosonde with balloon and para

A Review of the Operation and Inductive Coordination of Telegraph Systems

By A. L. St. Cyr and J. R. North

The Western Union Telegraph Co. and The Commonwealth & Southern Corporation, respectively

A NUMBER of years of field experience in the inductive coordination of power and telegraph systems has shown the need for a résumé of the technical basis of the coordination of power and telegraph facilities that could be readily applied and understood by all those concerned as well as by specialists in this field.

This review is therefore intended to give a general conception of the more important aspects of power systems as they affect induction into telegraph systems, and the characteristics of telegraph systems and their operation that affects their susceptiveness to induction. It is not intended to be a detailed technical treatise on the subject, but rather a guide to the practical application of the electrical principles of inductive coordination together with suggestions for workable and time-saving intercompany methods and routines.

Telegraph Systems

The usual commercial telegraph circuit for trunk service operates with ground return, with repeaters spaced at approximately 250 to 300 mile intervals. Individual circuits may extend through many repeater sections and may total several thousand miles in length. Lines of The Western Union Telegraph Company occupy the right of way of virtually all railroads in the United States. Transmission and reception are now by automatic means in all but a very small percentage of the facilities. The automatic printing telegraph system utilizes instruments very similar to typewriters in appearance, wherein the character transmission is initiated by manipulation of a keyboard and is automatically recorded by a printing mechanism at the receiving end.

Since an average operator's typing speed is less than the speed of character transmission capability of the usual telegraph line, a number of independently controlled printer systems may be operated over a single circuit by the use of distributors rotating synchronously at two terminals of the circuit. This arrangement is known as the multiplex printing telegraph system. A common type of such system permits four high speed circuits to be operated in each direction simultaneously over a single wire with ground return. By use of automatic switching arrangements, the multiplex system may be extended so that 30 or more subscribers may be provided with direct printing telegraph channels for use between private offices in widely separated cities. These switching facilities are arranged so that instant automatic connection is made between predetermined subscribers at any time and these connections are automatically released as soon as the subscriber ceases to use the facilities.

Ground return automatic telegraph circuits, unlike long distance telephone circuits, are quite susceptive to inductive disturbances at frequencies of from 25 to 300 cycles. The fundamental frequency of the signal impulses on multiplex systems depends on the speed of transmission and is usually in the neighborhood of 66 cycles. The higher the speed of transmission, the higher the line frequency and the shorter the length of the transmitted impulse. Since the proper operation of an automatic printer requires that a certain minimum impulse length be received correctly, the capability of character transmission over a telegraph system is determined by the length of the received impulse. False signals will result whenever the received impulse is less than the required minimum. The effect of any inductive disturbance present on a telegraph line is to distort the signal impulse and reduce its reliable length. To offset the effect of such distortion, the transmitted signal length must be increased by an amount equal to the loss caused by the distortion. The lengthening of the signal impulse may be secured only through the reduction of the operating speed of the telegraph system.

In addition to the multiplex printing telegraph system, an important telegraph service is the high speed ticker service such as used for stocks, bonds and commodity quotations, etc., which are transmitted simultaneously over networks covering the entire United States.

Telegraph systems at the present time are usually operated over conductors with ground return, either open wire, cable, or combinations of both. For certain types of facilities such as carrier systems, metallic circuits are used. Such metallic circuits are then composited for grounded telegraph service also. Direct current is used for signalling with the exception of the carrier system. In the latter a band of one or more frequencies is assigned for signalling purposes. In addition to these multiplex, teleprinter, ticker, and carrier systems, there are still some manually operated Morse lines. Usually the telegraph leads also carry voice frequency telephone circuits.

Effects of Induction on Telegraph Systems

The induction affecting telegraph circuits falls naturally into two classes: (1) that of large magnitude but of transitory nature occurring during faults to ground on paralleling power circuits, usually referred to as "abnormal" or fault current induction; and (2) that of smaller magnitude, but of a more or less continuous nature, present during ordinary operation of the power system and usually referred to as "normal" load current or voltage induction. Fault current induction is usually at power system fundamental frequency, whereas normal induction is usually at fundamental and third harmonic frequency. Load current induction consists of two general types: (a) induction from balanced conductor current; and (b) induction from the unbalanced conductor or residual current.

Fault Current Induction

Fault current induction is inherently short-time phenomena as practically all power systems are equipped with means for rapidly and automatically locating and clearing sections of lines involved in faults. However, the time required to perform these operations is from 0.1 to

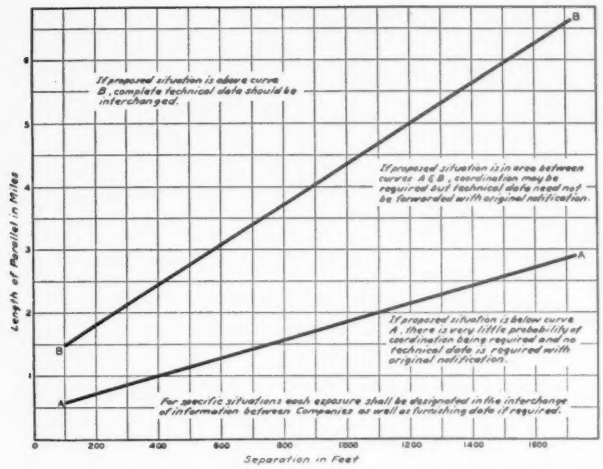

If proposed situation is above curve B, complete technical data should be interchanged.
If proposed situation is in area between curves A & B, coordination may be required but technical data need not be forwarded with original notification.
If proposed situation is below curve A, there is very little probability of coordination being required and no technical data is required with original notification.
For specific situations each exposure shall be designated in the interchange of information between Companies as well as furnishing data if required.
Length of Parallel in Miles
Separation in Feet

Fig. 1—Evaluation of Proposed Exposures Between Power Distribution Circuits (15 Kv and less) and Western Union Telegraph Company circuits to indicate possibility of Inductive Coordination Being Required.

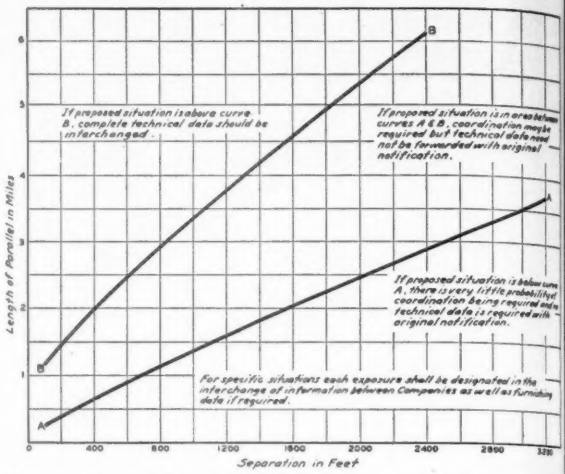

If proposed situation is above curve B, complete technical data should be interchanged.
If proposed situation is in area between curves A & B, coordination may be required but technical data need not be forwarded with original notification.
If proposed situation is below curve A, there is very little probability of coordination being required and no technical data is required with original notification.
For specific situations each exposure shall be designated in the interchange of information between Companies as well as furnishing data if required.
Length of Parallel in Miles
Separation in Feet

Fig. 2—Evaluation of Proposed Exposures Between Power Transmission Circuits (Above 15 Kv) and Western Union Telegraph Company circuits to Indicate Possibility of Inductive Coordination Being Required.

2.0 seconds or more, and this is a sufficient length of time to cause errors in transmission, loss of synchronism between circuit terminals, or operation of telegraph circuit protective equipment. Operating power companies recognize the importance of eliminating power system faults in rendering good service, and great progress has been made in system design, construction, and operation during the last 10 years to reduce the number of power circuit outages as well as their duration.

The seriousness of fault current induction troubles in telegraph circuits depends upon the magnitude of the induction, its duration, the number of successive occurrences, and the telegraph system susceptiveness. A single power fault between line and ground which is cleared very rapidly may cause only momentary errors in transmission over exposed telegraph circuits. However, transitory faults of longer duration, or a succession of momentary surges, associated with repetitive breaker operations, may result in the loss of synchronism between multiplex telegraph terminals.

Error in telegraph transmission that results from a single fault, if detected, may be corrected through retransmission. However, in the interest of accuracy, a succession of errors requires a suspension of telegraph transmission until correction is obtained. Manual observation is required to locate the section responsible for the suspension of transmission, or loss of synchronism. Thus the time required to restore interrupted service may be all

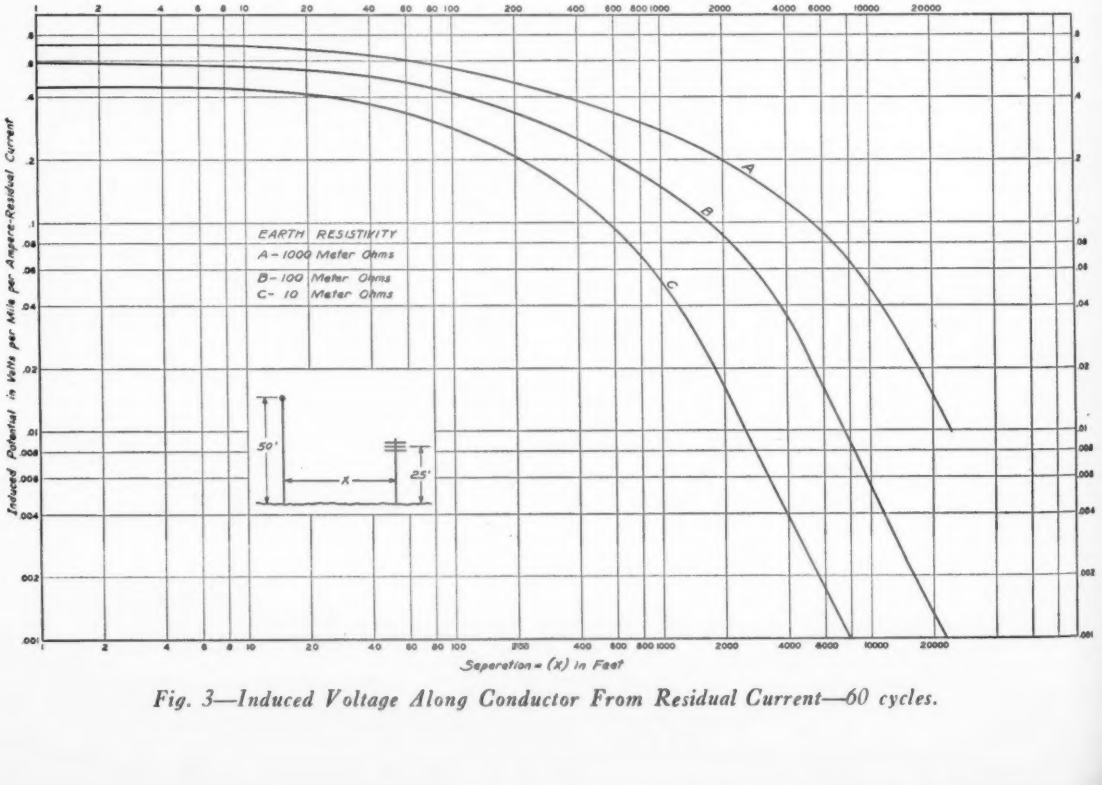


Fig. 3—Induced Voltage Along Conductor From Residual Current—60 cycles.

out of proportion to the duration of the induction.

Permanent grounding of protectors, such as may be caused by disturbances of long duration, requires considerable time for service restoration as many protectors at various points along the line may need to be replaced before the circuits can again be used. The voltage breakdown of telegraph office protective equipment is of the order of 350 volts rms value.

Induction Due to Load Currents and Voltages

The effects of induction on a telegraph circuit caused by exposures to a number of power systems are combined vectorially according to phase relation over the length of the circuit. This fact, together with the rapid growth in the extent and number of distribution systems, has increased the importance of inductive problems to the telegraph companies. These inductive effects are manifested as a distortion of the received signals, which in turn results in the shortening of the signal impulses. The amount in time by which a received signal impulse is shortened from the transmitted impulse is a measure of the transmission impairment.

For the purposes of telegraph transmission evaluation, any induction may be resolved into its direct current equivalent effect upon the receiving relay, and since this relay has inductance, the magnitude of any specific induced voltage results in currents which diminish as the frequency increases. Therefore, in impulse telegraph transmission, voltages induced at the lower frequencies (below say 300 cycles) have a greater distortion effect upon transmission than those resulting from the higher frequencies. In carrier circuit transmission, only the higher frequencies (above 300 cycles) are likely to have any effect, excepting, of course, the composited telegraph circuits which may be derived from the metallic carrier circuit facilities.

Since by far the majority of telegraph circuits are of the ground return type, longitudinal induction from power line exposures causes current to flow through the same paths as the signal current, thus making such telegraph systems particularly susceptive to induction of this sort. Since the coupling between telegraph and power systems is much greater for the residual components of induction than for balanced components by a factor upwards of 100 to 1, induction from ground return residual currents is particularly serious.

Inductive Influence of Power Systems

The important influence factors of power systems are those which give rise to excessive longitudinal induction in telegraph circuits. Such longitudinal induction may be caused by residual current or large load current on the power system, and in some cases by high voltage. The amount of the induction is a function of the magnitudes of these quantities and their respective coupling between the power and telegraph circuits.

For exposures involving transmission lines, induction during normal operation of the power system and also during line to ground faults is of importance. The normal induction may be caused by balanced currents directly, or indirectly through the action of these balanced currents in producing ground return current in the overhead ground wires or other grounded conductors carried on the transmission line. This latter effect may be an important consideration when the ground wires are of high conductivity. Distribution lines, except those with multigrounded neutral, seldom present important induction problems. For exposures to multigrounded neutral systems, however, the load current induction due to the residual component returning in the earth is usually the most important consideration.

Induction due to load currents may be experienced even though the loads on the three phases are balanced. The coupling is dependent on the configurations of the power and telegraph conductors, separation between lines, length of the exposure, and presence of overhead ground wires and other shielding conductors.

Induction due to residual load currents and residual fault currents is proportional to the unbalanced conductor current returning in the earth. The coupling is dependent on the separation between the power and telegraph lines, the earth resistivity in the section involved, and on the length of the exposure. It is practically independent of configuration of the conductors but the presence of shields must be taken into consideration. Typical coupling curves for residual current induction are shown in Fig. 3 and for balanced three phase current induction in Figs. 4 and 5.

In rare situations induction due to voltage may be experienced in close exposures to untransposed high tension transmission lines. The coupling is dependent on the configurations of the power and telegraph conductors and on the separation between lines.

For a given separation and length of exposure, the residual current coupling is many times that of the balanced current coupling and is therefore of great importance to the telegraph companies. In addition to the fundamental frequency components, the residual current may contain the odd triple harmonics of the fundamental of which the third harmonic (180 cycles) is particularly troublesome to automatic printing telegraph equipment. For this reason, telegraph induction tests are usually made at fundamental and third harmonic frequencies.

Line to ground fault currents are usually large compared to residual load currents and may cause voltages to be induced on the telegraph conductors of sufficient magnitude to operate protective equipment. If the faults are of more than momentary duration, they may cause permanent operation of such devices, resulting in the signalling circuits being permanently grounded. Because of the magnitude of the currents involved, only the fundamental frequency components are usually of importance in fault current induction.

Theoretical considerations and tests on multi-grounded neutral systems have shown that on single phase portions from 50 per cent to 90 per cent of the current at any point in the circuit may flow in the earth. Similarly for the three phase portions of such systems, from 10 per cent to 50 per cent of the current at any point may flow in the earth. In many cases that arise in the field, especially those involving new construction, it is not practicable to determine just how much current may flow in the earth through a communication system exposure. As a matter of convenience in preliminary analysis, and based on considerable field experience, the following approximations have been used:

(a) For single phase portions of multigrounded neutral systems, a figure of 50 per cent of the maximum rated "ultimate" circuit load current is taken as the value of the current flowing in the earth.

(b) For three phase portions, a figure of 10 per cent of the maximum rated "ultimate" circuit load current is taken as the value of the current flowing in the earth.

On the three phase portions, the load return current could theoretically be confined entirely to the conductors if perfect load balance could be maintained between the three phases. However, even if such a system were balanced when it was installed, it would be subject to the

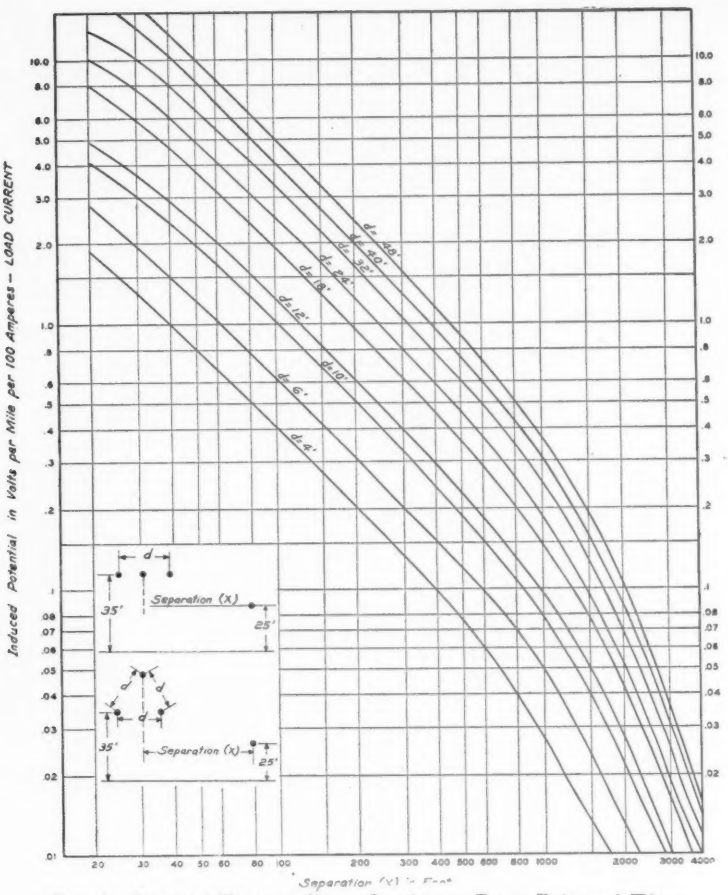


Fig. 4—Induced Voltage Along Conductor From Balanced Three Phase Currents Horizontal and Triangular Configuration—60 cycles, 20 meter ohms.

normal variations in the daily load and most of the additions and extensions to the system would be single phase so that it becomes impractical to maintain a high degree of balance on facilities of this type. Furthermore, so far as the telegraph system is concerned, it is important that the current balance be maintained within the exposure itself whether or not the system as a whole is balanced.

It is for these reasons that emphasis is placed on the importance of considering coordination of telegraph lines with multigrounded neutral systems while construction or conversion plans are still in the preliminary stages.

Inductive Coordination

The chief factors involved in any inductive coordination situation are:

1. *Influence*—the character and intensity of inductive fields set up by the supply circuit current and voltages.

2. *Coupling*—a function of the separation between the two lines, their configuration, length of the exposure, and the resistivity of the earth.

3. *Susceptiveness*—the term applies to those factors of the communication circuit which make them adversely responsive to induction.

4. *Shielding*—the effect of current set up in paralleling conductors which tend to modify the effective induction into the communication circuits.

The magnetic field of the primary source of any induction acts upon all conducting material within an exposure. This action may result in current flow in these conducting materials. When the magnetic field associated with the current induced in the conducting materials acts to oppose the field of the primary source, the conducting material may be considered as shields. In the usual situation encountered in the field the effect of these conducting materials is similar in effect to lowering the earth resistivity and may be allowed for in the coupling coefficients.

The magnitude of induction for a given exposure may be calculated knowing the length of exposure, separation between lines, magnitude of the various components of the supply line current and the shielding which may be involved. Coefficient curves have been developed so that the coupling between any two paralleling lines may be readily determined with a degree of accuracy

INDUCTIVE COORDINATION INFORMATION SHEET A

DISTRIBUTION LINE

Power Utility _____

Address _____

Designation of line _____ From _____ To _____

Type of system: Isolated neutral _____ Unigrounded _____ Multigrounded _____ Series Lighting _____

3 Phase – 3 Wire _____ 3 Phase – 4 Wire _____ 2 Phases and neutral _____ Single Phase _____

Phase to neutral voltage _____ KV Number of phase wires in exposed section _____

Neutral conductor size _____ Material _____ % Conductivity _____

Length of exposure proposed _____ Existing _____ ;Separation between power and W U line _____

Length of connected line beyond start of exposure, miles 3 Phase _____ 2 Phase _____ 1 Phase _____

Maximum phase current in exposure Initial _____ Ultimate _____

To what extent are load currents balanced in exposed section? _____

Over current protection – Circuit breaker relay setting _____ Fuse rating _____

Supplemental data attached: Diagram of distribution circuits involved in exposure _____

Map _____ Diagram of pole showing spacing between wires _____

Remarks _____

By _____

Title _____

Address _____

Date _____

quate for this work. These curves have been plotted for the more representative conditions, one set for balanced currents and one set for residual currents in the supply lines. The use of these curves gives the open circuit induced voltage from which the current in the signalling circuit can be calculated knowing its impedance.

Since the coupling for balanced currents differs for the various configurations of power lines, the curves are plotted for several of the more common configurations. The induction from configurations differing slightly from these selected configurations may be estimated by the use of the curve which is closest to the configuration involved. Where greater accuracy is desired, special curves or computations may be required. Since the coupling for residual components is influenced to a considerable extent by earth resistivity, the curves are plotted for a number of earth resistivities.

Practical Coordination Procedure

The Principles and Practices formulated by the Joint General Committee of the Edison Electric Institute and The Western Union Telegraph Company established the basis for mutual consideration of inductive coordination problems involving power and telegraph systems. In any situation, either existing or proposed, by far the most important element is a mutual understanding and

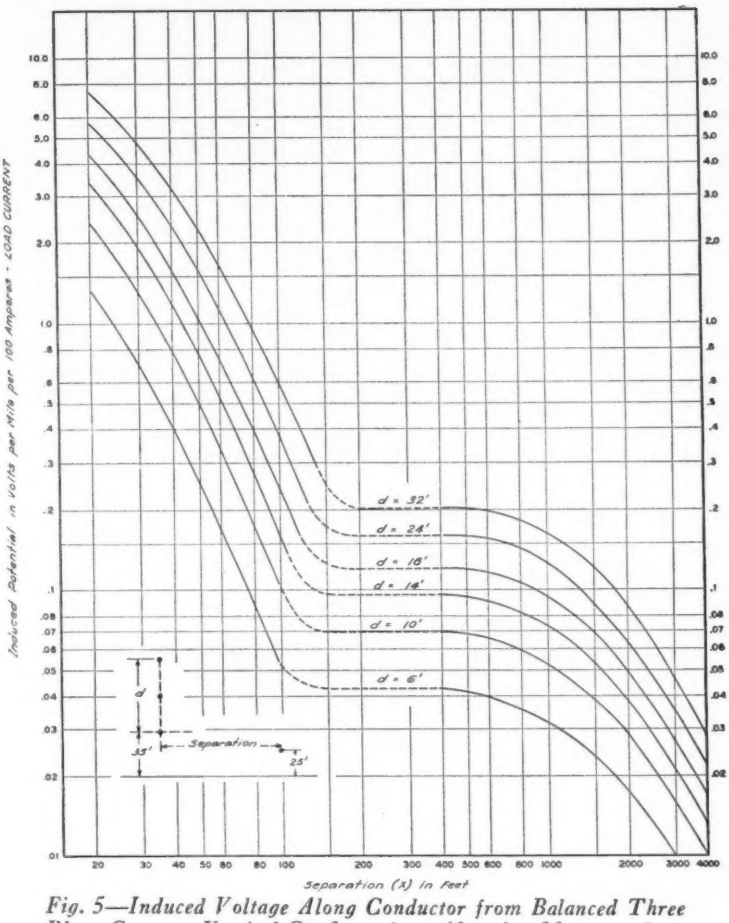


Fig. 5—Induced Voltage Along Conductor from Balanced Three Phase Currents Vertical Configuration—60 cycles, 20 meter ohms.

INDUCTIVE COORDINATION INFORMATION SHEET B

COMMUNICATION LINE

Line Designation _____

Exposure between _____ and _____

Line located on _____ RR)
HW)

	Western Union	Railroad
Number of copper wires:		
Number of iron wires:		
Ultimate number of wires:		

Number of Western Union circuits: Carrier _____

Telephone _____ Automatic Telegraph _____ Morse _____

Number of Railroad circuits: Carrier _____

Telephone _____ Automatic Telegraph _____ Morse _____

Transposition system used _____

Present signal system or train control and type _____

Present repeater locations _____

Remarks _____

By _____

Title _____

Address _____

Date _____

appreciation of all the factors involved. These factors may best be given consideration during the preliminary stages of any project and before any commitments have been made.

The first step is the assembly of information concerning the general features of the power and communication facilities involved. This usually consists merely of a description of the general location and route (actual or proposed) of the lines and the type of power and communication facilities. Using these data, preliminary estimates of the coordination aspects of a given situation may be made using the charts designated as Figures 1 and 2. This preliminary analysis will generally indicate whether the situation will require further detailed study, in which case information should be obtained along the lines as illustrated by the accompanying "Inductive Coordination Information Sheets A and B." *In all cases*, however, notification of proposed construction should be given in accordance with existing rules and regulations.

Fig. 1 for the preliminary evaluation

of distribution exposures was prepared with a view toward giving in readily usable form a first approximation and a direct appreciation of the magnitudue of the usual coordination situation involving distribution circuits. Practical experience with this chart for over two years has demonstrated its broad usefulness in numerous situations. The zones are based on certain assumptions of typical load current, conductor size, configuration, earth resistivity, and limiting values of induction as are frequently encountered in the field. The use of this chart will indicate for a given exposure the relative importance of the coordination problem. For example, where the length of the exposure and separation between circuits apply in the area below line A, the importance from an inductive coordination standpoint will probably be negligible, and notification with classification of contemplated construction will generally be sufficient. For exposure conditions lying in the middle zone between lines A and B (which may be considered as borderline cases) there is a possibility that further study may be required, but it generally is not necessary to furnish detailed technical data with the original notification. For exposure conditions lying above line B, the inductive coordination problem may be of considerable importance and there should be a complete interchange of data (using "Inductive Coordination Information Sheets A and B") concerning the proposed and existing power and communication facilities so that the necessity for full consideration of coordination may be determined.

Fig. 2 similarly applies to proposed transmission circuit exposures.

Computations of the magnitude of the induction may be made for the common types of situations by means of typical coupling curves as given in Figures 3, 4, and 5.

In making calculations of residual current induction, the power system, whether three phase or single phase, can be represented as an equivalent single phase circuit with earth return, carrying current equal to the net current returning in the earth on the system, allowance being made for the influence of shielding conductors and future system growth. The current returning through the earth and shield wires can be determined for any circuit whether it be three phase three wire, three phase four wire, two phase and neutral, or single phase, by obtaining the vector sum of the current in all the conductors on the power line.

Specific Coordination Means

It is assumed in any situation that both the telegraph and power systems will be constructed, operated, and maintained in accordance with modern commercial standards.

In those situations where review of the facts indicates that the construction as existing or proposed will require extensive coordination, the provision of adequate separation in so far as practical and economical will be effective in reducing the induction. In many cases, sufficient separation may be impracticable or uneconomical, and then the following means for coordination should be considered:

For application to telegraph facilities—

(a) Use of neutralizing equipment such as shunts or reactors, neutralizing transformers or amplifiers.

(b) Conversion of ground return type of telegraph circuits to carrier systems.

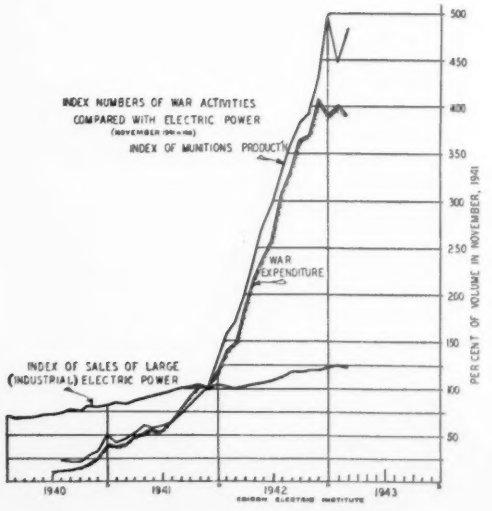
For application to power systems—

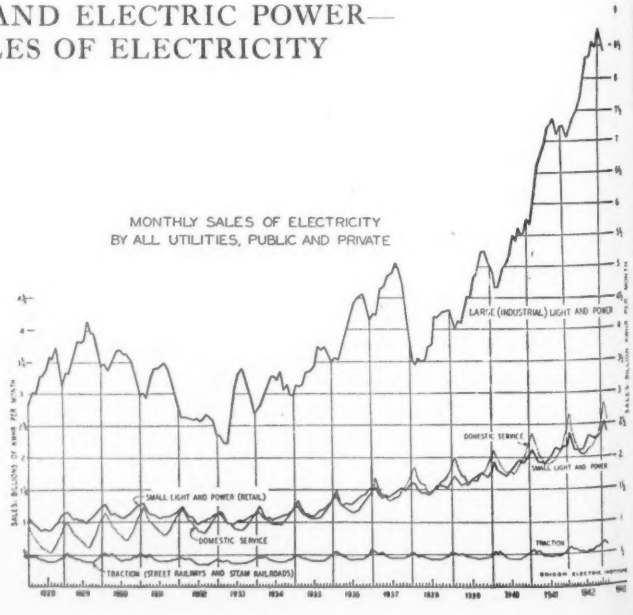
(a) Reduction in frequency and duration of faults.

(b) Improvement of balance of power system within the exposure.

It should be appreciated that coordination by separation permits both utilities to enjoy a maximum flexibility in the use of their plants. Where this is impracticable and uneconomical, it is necessary to consider the application of specific coordinate measures. These should be determined through a joint engineering investigation so that by complete cooperation between the utilities involved in planning, in locating the lines, in the choice of systems, and in the methods of operation, the best engineering solutions of the mutual problems may be determined to best provide for the proper growth and development of both power and communication systems.

WAR ACTIVITIES AND ELECTRIC POWER— MONTHLY SALES OF ELECTRICITY





Some Features of Wood H-Frame Design for High-Voltage Line Structures

By W. C. Schmidt

Commonwealth and Southern Corp., Jackson, Mich.

Presented before a meeting of the Transmission and Distribution Committee, EEI, at Pittsburgh, Pa., February 11 and 12, 1943

NOT so many years ago there was considerable reluctance to use wood for important high voltage line structures. As a result, large parts of our transmission systems are of steel tower construction. In recent years a trend from steel to wood has taken place, the reasons for which are obvious to all of us who are interested in line design. With an ever-increasing knowledge of the mechanical behavior of various woods and wood connections, guesswork and rule of thumb methods have all but disappeared from wood design with the result that wood now takes on a new importance as an engineering material. Improvements in wood preservation have removed the uncertainty when the choice of wood is made for important structures. Also, in recent years it has been learned that wood, if properly applied, will provide valuable insulation against lightning voltages while at the same time serving structural functions.

All of these facts, together with economic considerations, have led to the marked increase in the use of wood structures for transmission lines. Temporarily, a new incentive exists, to save critical materials during the period of the war.

With the increase in the use of wood there have appeared a great many variations in design. Nearly all are based on the familiar "H" structure with the three conductors supported in horizontal arrangement on a single crossarm which in turn is supported by two wood poles. The ground wires when used are usually supported at or near the tops of the two poles. Beyond these basic considerations similarity of design abruptly ends and there exists a multitude of structure styles, each considered by its creator as the most suitable for his particular application.

Through these years we have evolved and adopted a series of "H" frames for 138,000-volt service which has been used since 1939. The design has been used on various conductor sizes, ranging from No. 4/O ASCR to 300,000 cm copper. There is nothing new in the general outline of this design. However, it is proposed to show pictures of the various structures and certain other details in the hope that certain features may prove to be of interest and evoke discussion from which all of us may derive some benefit.

Tangent Structure—Fig. 1

Fig. 1 shows the tangent structure which is used on straight line applications only. It is a flexible unbraced structure and therefore its transverse strength is approximately the sum of the breaking strengths of the two poles. Within the safe limits of this strength it is our opinion that this type of structure is most economical and satisfactory for the majority of applications.

All wood parts except western red cedar poles are pressure treated with creosote, although the use of other treatment is seriously being considered. Up to the present time butt treatment only has been specified on western red cedar poles because shell rot has not been a serious problem in the territory in which we operate.

The lower table shows maximum permissible spans for given structure heights for factors of safety of 3 and 4, for an application using ASA Class 2 WRC poles. These factors of safety are based on the fifth edition of the NESC. A minimum factor of safety of 3 is used for ordinary cross-country construction, and a minimum factor of safety of 4 is used at locations where the requirements of grade B construction must be met.

The second table shows impulse insulation levels of the structure under various conditions. The basic considerations follow closely that for steel towers designed in recent years for lines of this voltage. In tower design a minimum striking distance of 5 ft 6 in through air under conditions of a temperature of 60 F and no wind is main-

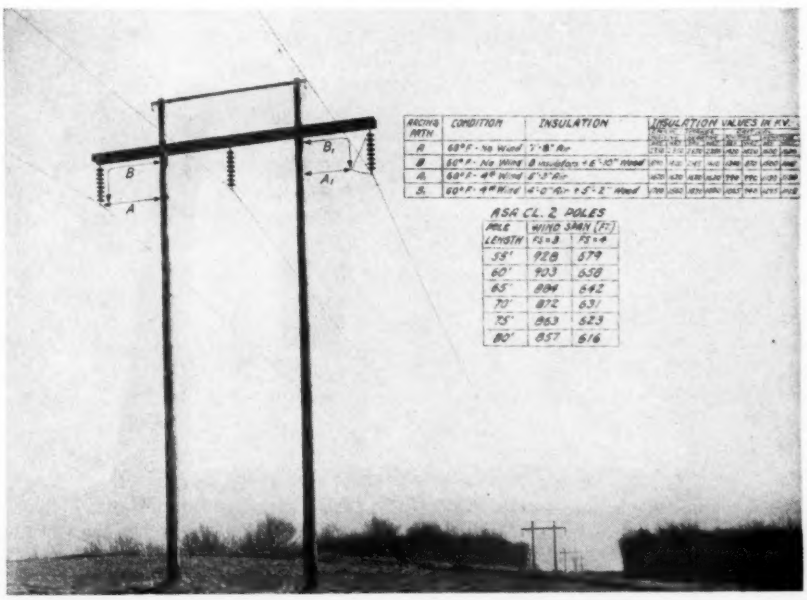


Fig. 1—Tangent Structure

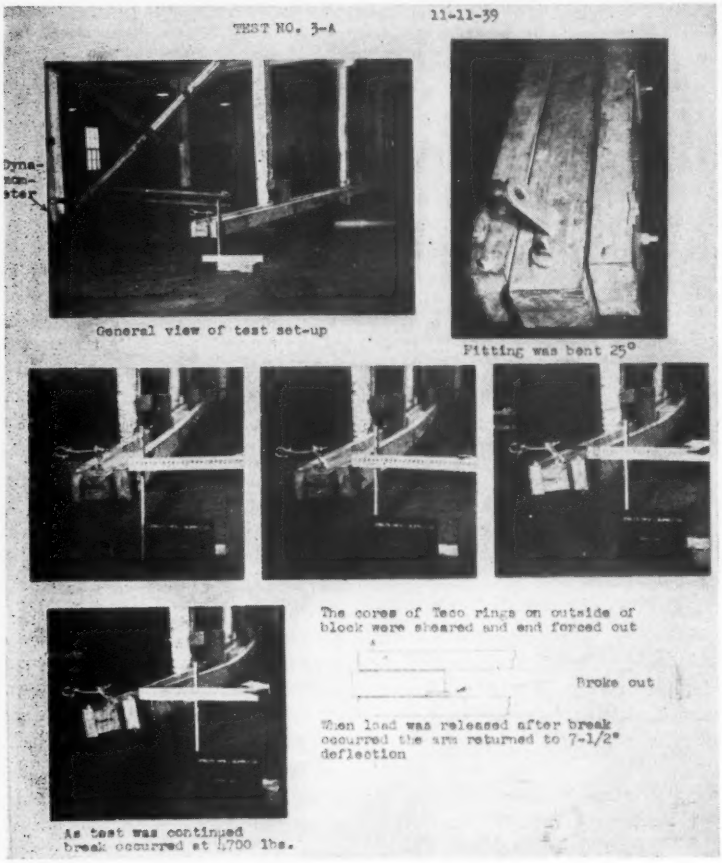

TEST NO. 3-A
11-11-39
General view of test set-up
Fitting was bent 25°
The cores of Teco rings on outside of block were sheared and end forced out
Broke out
When load was released after break occurred the arm returned to 7-1/2° deflection
As test was continued break occurred at 4,700 lbs.

Fig. 2—Test 3a on Filler Block

tained. This striking distance is reduced to 5 ft under conditions of 60 F with a wind pressure of 4 lb per square foot, resulting from a 40-mile per hour wind.

In the wood structure advantage is taken of the insulation value of wood to lighting voltages. Various combinations of primary and wood secondary insulation were set up and the best approximate balance selected with impulse levels no less than those for the striking distances mentioned above. In making this choice structural limitations as well as the insulation required for normal frequency voltages were kept in mind. The result was a combination of eight 5¾-in x 10-in suspension insulators and approximately 7 ft of wood. The resulting impulse insulation levels are shown in the table. We recognize that the two micro-second values do not necessarily represent the insulation obtained under direct stroke conditions. However, it is felt that by utilizing both the two micro-second and critical values on a comparative basis a proper design can be obtained.

The shielding angles of the ground wires are approximately 45 deg at the structure which are somewhat decreased at mid-span due to the fact that the overhead ground wires are always installed with less sag than the conductors. The combination of shielding, insulation levels and low earth reistance discussed later has resulted in an excellent operating record during lightning storms which should continue indefinitely.

The crossarm is a 32-ft double plank crossarm with wood filler blocks at the ends and center. This choice was made after careful consideration of other types of crossarms such as the round spar crossarm or single sawn timber. The spar crossarm has some advantages but involves problems of connections to poles and hardware and has the disadvantage of the single arm under lightning conditions. The double plank crossarm eliminates these disadvantages and offers other important features. By the use of filler blocks and timber connectors the strength of the assembly is very great for the amount of wood used. The use of timber connectors throughout the design enormously simplified the connection problems. The use of filler blocks eliminated all drilling in the planks for the various combinations of fittings, as all insulator fittings, knee braces and other hardware are attached directly to the bulky filler blocks.

Test 3A on Filler Block—Fig. 2

A series of full scale tests which may be of interest was made at the Morgan Street Plant of the Joslyn Manufacturing and Supply Company in Chicago.

Fig. 2 shows a static bending test on a double plank crossarm and filler block assembly using 4-in timber rings. On close inspection it can be seen that the block and arm are separated. In these first tests the rings were sunk but ⅜ in into the wood members instead of the normal ½ in. This was done to provide a breathing space between the wide wood surfaces as the use of untreated wood was being considered.

One end of these planks was fitted with the filler blocks and rings and the other end was fitted with a conventional steel fitting. The crossarm was subjected to bending loads as shown and deflection recorded versus load until initial failure occurred. From the tests it can be seen that first failure occurred at 4700 lb when the wood sheared out ahead of the split ring connector.

The crossarm was then turned end for end and the test was repeated on assembly using metal fittings. Failure of the crossarm in bending occurred at 3200 lb.

Tests were also made on a complete assembly with filler blocks and with the 4-in timber rings at full depth. At 5000-lb load, the assembly failed when the split ring connectors sheared out.

In all assemblies involving split ring connectors failure occurred when the rings sheared out due to longitudinal shear in the wood blocks or crossarms. The end distance used in the tests was 6 in. This was increased to 7 in in the actual design of the structures.

Summary of Static Bending Tests—Fig. 3

Fig. 3 shows a summary of the static bending tests which were conducted. The curves show load vs deflection to the point of initial failure. As indicated, curves 3B and 4B are the results of the tests on the assemblies with metal fittings only. Curves 3A and 4A cover tests on filler block assemblies with the 4-in split ring connectors imbedded in into the wood members. Curves 5A, 5B, 6A and 6B cover tests on filler block assemblies with the 4-in timber rings imbedded full depth.

In addition to the static bending tests a modified impact test was made on full

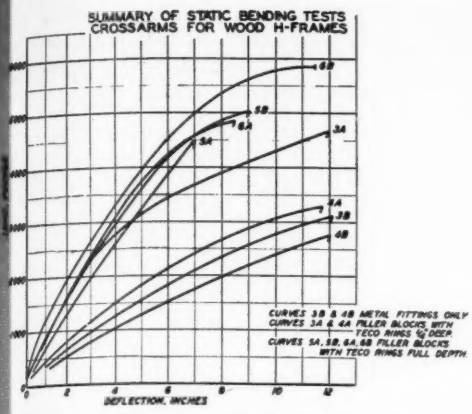
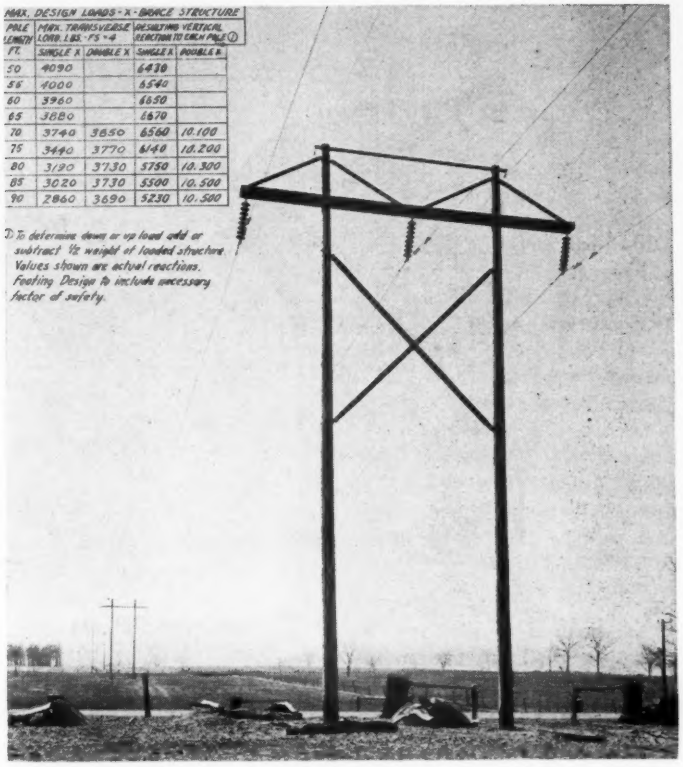


Fig. 3—Summary of Static Bending Tests



MAX. DESIGN LOADS - X-BRACE STRUCTURE

POLE LENGTH	MAX. TRANSVERSE LOAD, LBS. - FS = 4		RESULTING VERTICAL REACTION TO EACH POLE ①	
FT.	SINGLE X	DOUBLE X	SINGLE X	DOUBLE X
50	4090		6430	
55	4000		6540	
60	3960		6650	
65	3880		6670	
70	3740	3850	6560	10.100
75	3440	3770	6140	10.200
80	3120	3730	5750	10.300
85	3020	3730	5500	10.500
90	2860	3690	5230	10.500

① To determine down or up load add or subtract ½ weight of loaded structure. Values shown are actual reactions. Footing Design to include necessary factor of safety.

Fig. 4—X-Brace Structure

scale assemblies. These tests were made to learn how the assemblies would stand up under shock load similar to that which would occur if a conductor suddenly broke. In these tests a known load was applied to the arm which was supported by an electro-magnet. By opening the magnet circuit, the full load was instantly applied. Because of the rigid mounting of the assemblies this was a severe test but the comparative results are of interest. A 2500-lb load was applied to the end of the crossarm with the metal fittings. The load was too great and failure occurred instantly. The initial load was reduced to 2000 lb and the arm was turned end for end and a test made on the filler block assembly. This assembly like some of those discussed in static bending test was made with the rings imbedded ⅜ in.

The initial load of 2000 lb caused a small crack but the deflection after the crossarm came to rest was but 4 in. The load was increased to 2500 lb and dropped, causing additional cracking but no failure. Deflection with static load after this test was 6½ in. The 2500-lb load was dropped again and the deflection increased to 7 in. The 2500-lb load was dropped a third time and the deflection increased to 11 in. Failure was imminent so the test was discontinued.

None of these tests were comprehensive enough to be used to establish values for the strength of the crossarm assemblies. Like all tests on wood the results vary widely due to variation in the quality of timber used. The wood pieces were purchased locally and some did not measure up to the standard required for dense select structural grade of fir. However, the tests were conclusive in proving to our satisfaction that the filler block assembly is superior to the assembly using simple metal fittings and contributed in a large measure to the choice of this design.

Another sidelight may be of interest. Although nearly all of the crossarms and blocks are fabricated and treated on the Pacific Coast, a degree of accuracy in framing is specified and received that it is practicable to ship the parts unassembled. All pieces of the same framing are interchangeable and no markings are found necessary. The various styles of crossarm assemblies are usually put together at unloading points along the line and hauled to final locations. This has an advantage in that the wood parts can be purchased as structural timber entirely apart from hardware and fittings.

Fig. 5—Footing for X-Braced Structure

X-Brace Structure—Fig. 4

The X-brace structure is similar to tangent structure with the addition of knee braces and of one or two X-braces as required. To provide adequate insulation from the center conductor to ground it was necessary to increase the pole spacing 2 ft, resulting in planks 34 ft long. At those locations where the insulator swing exceeds the allowable angle for the structure shown the crossarm is offset 1 ft and short swinging brackets are provided for insulator attachments. This makes it possible to utilize the structure to the full limit of its mechanical strength.

The torsional load on the crossarms under broken conductor condition is reduced by the use of swing brackets similar to the commonly used tower bracket.

The table shows maximum transverse loads permitted with this type of structure which permit the structure to be used at line deflections, ranging up to approximately 5 deg with normal span length.

The table also shows the resulting vertical reactions in each pole. These reactions are appreciable, especially in

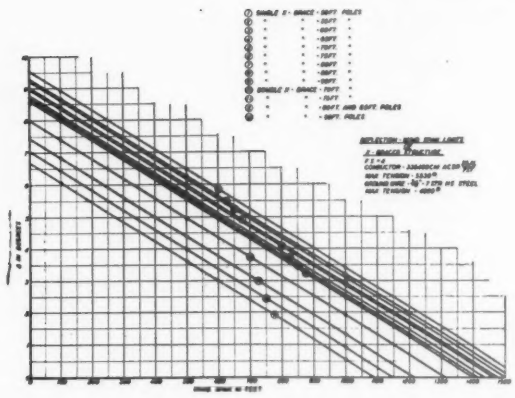


Fig. 6—Span-Deflection Curves

the tall double "X" braced structure and usually require supplementary footings to take care of the bearing and uplift.

Footing for X-Braced Structure—Fig. 5

The footing usually used is a 3-ft square wood plank shoe installed at the base of the poles. Figure 5 shows one of these shoes with the attachments for uplift. The shoes for compression poles are either put into the holes before the pole is set or are lagged to the pole butt and installed with the pole.

Span-Deflection Curves—Fig. 6

These curves are shown to illustrate the type of data which is prepared for field use and cover a typical application of the X-braced structure for a line using 336,400 cm ACSR conductors and two 3/8-in galvanized steel ground wires. The total transverse load is the sum of the transverse load due to wind the transverse load due to the deflection in the conductors and ground wire and is a constant for each of the various X-braced structures.

These curves show the various com binations of span length and deflecti permitted for each type of structure a are a great time saver.

Light Angle Structure—Fig. 7

The light angle structure is used cover the difficult range between t X-braced structure and the simple pul off structure. All loads are transmitt through the arms to the back pole whi is guyed. The crossarms in two pie to avoid excessive lengths and also provide flexibility to take care of slig differences in pole setting. The use timber connectors is especially helpf in transmitting the forces to the guy pole. To provide proper clearances sulator bracket lengths up to 24 in a necessary. This structure has recen been improved by raising the point attachment of the lower guy to the le of the crossarm and lengthening t crossarm to compensate for the loss insulation which would have be caused by the change.

A shoe identical to the one used the X-braced structure is installed u der the back pole when the compressi load exceeds the bearing value of t soil.

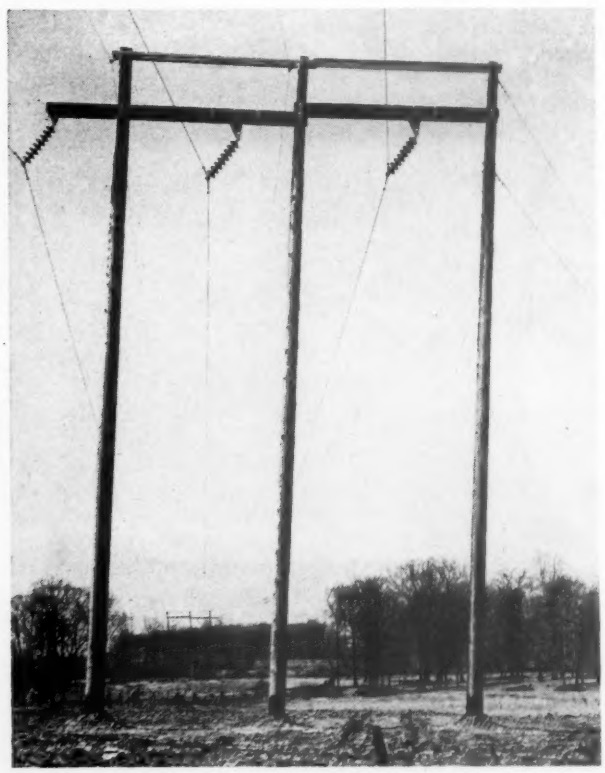


Fig. 7—Light Angle Structure

Fig. 8—Pull-off Structure

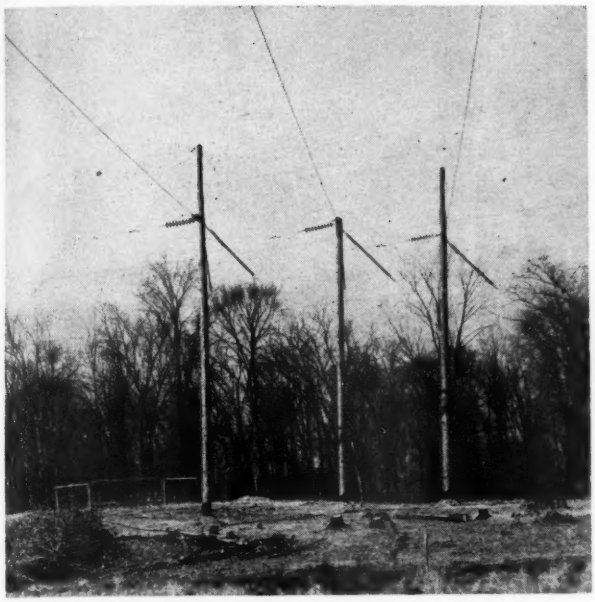


Fig. 9—DE Structure

Pull-off Structure—Fig. 8

The pull-off structure consisted of ree independent poles individually yed. The poles are spaced 20-22 ft art to provide clearances to guys. To ovide proper shielding angle the round wires are installed about 15 ft ove the conductor.

In the lower range of line deflections e conductors are held away from the le by using a swinging bracket. For ger line deflections insulators are at-ched directly to the pole.

DE Structure—Fig. 9

The dead end structure is also a three-pole structure individually guyed. The particular structure shown is at the junction of a wood H-frame line and steel tower line.

The design of proper guy attachments for heavily loaded poles is a difficult problem. After carefully considering pole bands and other devices currently used, a design was adopted consisting of a simple, efficient assembly using TECO shear plates.

Guy Attachment Asembly—Fig. 10

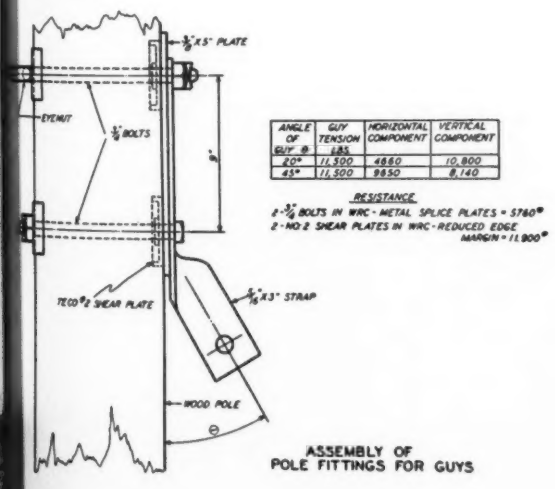
Fig. 10 shows the assembly used. You will note it derives its holding power from two 4-in shear plates held in place by two ¾-in bolts. The necessity for the shear plates can readily be ascertained from the tables. Using an 11,500-lb guy strand with a guy lead to produce a 20-deg guy angle, the vertical component is 10,800 lb. The maximum permissible load with two ¾-in bolts and no shear plates would be but 5760 lb. The use of shear plates increases this permissible load to 11,900 lb.

Before one can proceed with the design of important wood structures for an H-frame line or any other purpose it is necessary to determine maximum safe loads for the proper design of bolted joints. This feature is often neglected and it is our opinion that the only reason more trouble is not experienced with many structures installed is due to the fact that most structures are never subjected to the loads for which they were intended to be designed.

Holding Power of ¾-In Bolts—Fig. 11

Fig. 11 illusrates the type of basic data used in the design of these frames. These curves show maximum load in relation to "angle of load to grain" for ¾-in bolts in western red cedar poles.

The basic stresses used are from tests made at the United States Forest Products Laboratory. We have taken the basic values from data obtained in these tests, removed the factor of safety and computed a series of curves for design use. The curves are plotted using an



ANGLE OF GUY θ	GUY TENSION LBS.	HORIZONTAL COMPONENT	VERTICAL COMPONENT
20°	11,500	4860	10,800
45°	11,500	9850	8,140

RESISTANCE
2-⅞" BOLTS IN WRC - METAL SPLICE PLATES = 5760#
2-NO 2 SHEAR PLATES IN WRC - REDUCED EDGE MARGIN = 11,900#

Fig. 10—Guy Attachment Assembly

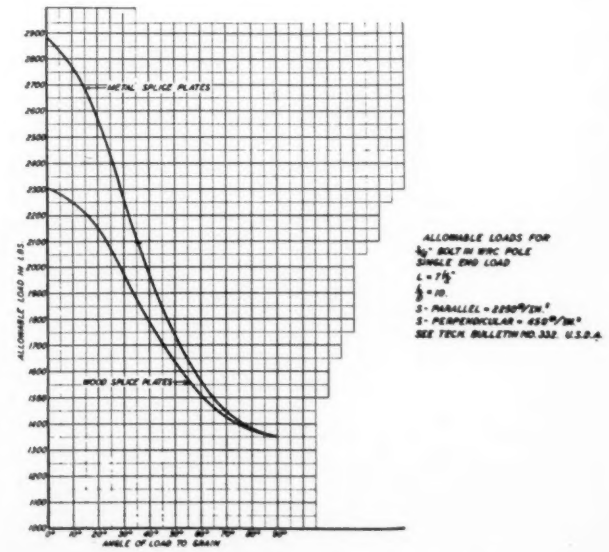

METAL SPLICE PLATES
WOOD SPLICE PLATES
ALLOWABLE LOAD IN LBS.
ANGLE OF LOAD TO GRAIN
ALLOWABLE LOADS FOR
⅞" BOLT IN WRC POLE
SINGLE END LOAD
L = 7½"
D = 10.
S - PARALLEL = 2250#/IN.²
S - PERPENDICULAR = 650#/IN.²
SEE TECH. BULLETIN NO. 332. U.S.D.A.

Fig. 11—Holding Power of ¾-In Bolts

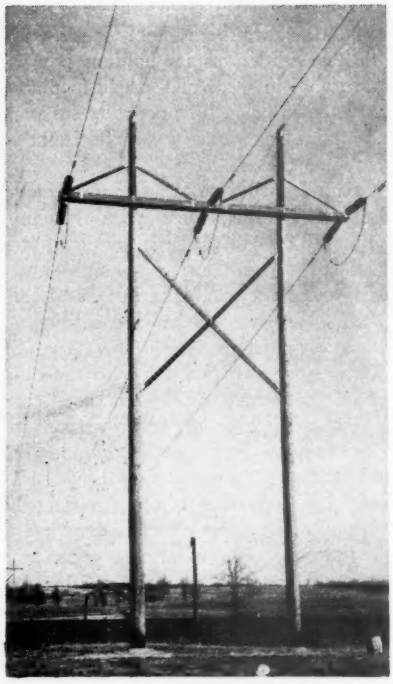


Fig. 12—DE RR Structure

empirical formula and ratio of bolt length to bolt diameter of 10. A small variation in this ratio has but little effect and the curves can be used for general applications in western red cedar poles.

DE RR Structure—Fig. 12

This structure is a straight line RR crossing structure installed several years ago. It is of interest only because it is representative of a short era, the transition period between the fourth and fifth editions of the NES Code. We have removed the longitudinal guys but the conductor dead end still remains. This structure would not be installed today. Instead it would be the tangent or conventional X-braced structure, whichever would be required to meet necessary transverse strength requirements.

Ground Rod Assembly—Fig. 13

Probably no other design factor has greater influence on the performance of a transmission line than the impedance of the connections to earth. In the desire to reduce the footing impedance to an economic minimum, use has been made for some years of single sectional rods of rather long lengths instead of short rods driven in multiple. These rods of 5/8-in diameter are of black copper bearing steel usually in 8 or 12-ft lengths and are joined by means of drive fit couplings. The sectional details of the

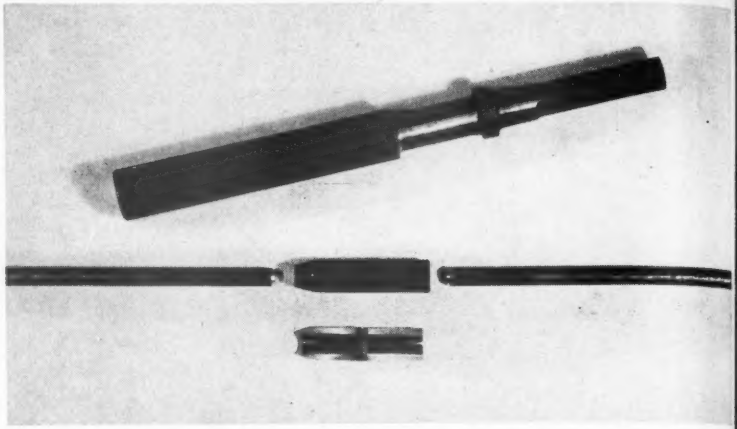


Fig. 13—Ground Rod Assembly

coupling show the longitudinal serrations which form the tight joint. Specimen joints have been tested after driving to determine the fit of the couplings and with rods varying from .620 in to .630-in diameter, the holding power of the couplings is from 4000 lb to 4600 lb. With couplings of such design it is very necessary to control the fit between coupling and rod so the rod will seat properly in the coupling under either easy or hard driving conditions. The only machining necessary on the rod is to slightly bevel each end in order to remove the burr caused by the shearing operation.

These rods are driven by means of a Barco gasoline hammer using the special tool shown.

(*Continued on page* 124)

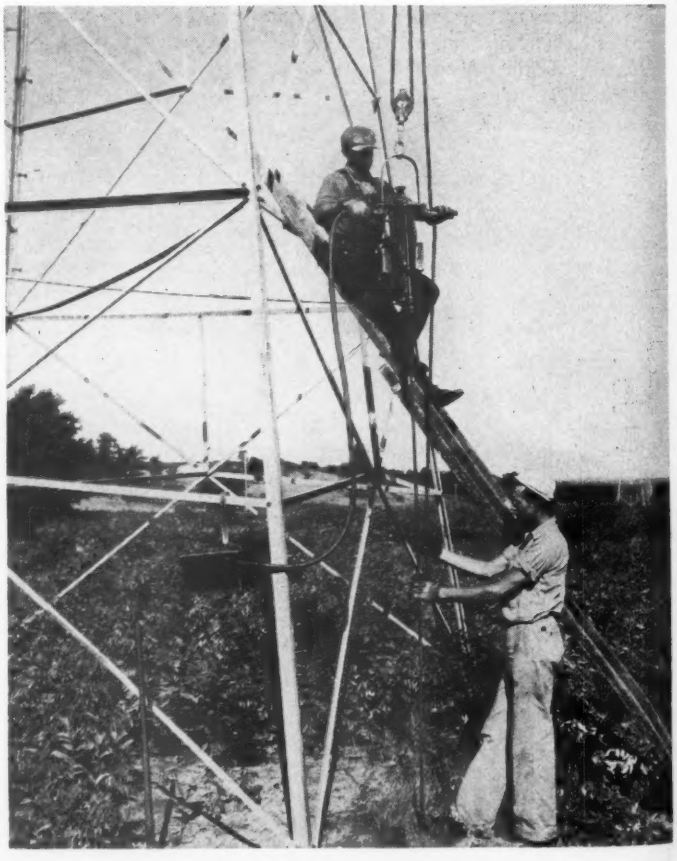


Fig. 14—Driving Rods

"As Our Territory Prospers So Shall We"

Is Long-term Philosophy of Farming for Better Living Program

By Roy W. Godley
Monongahela West Penn Public Service Company

THIS year our "Farming for Better Living" program—an important part of the Monongahela System's rural service activities—has gone to war. It is essential to the war effort because it is out on the home front fighting line pushing production of foodstuffs and trying to make the farms' family unit self-sufficient on its own acres, releasing the foodstuffs from "surplus areas" for our armies and our allies. But it doesn't lose sight of the fact that a farmer must take care of his soil, that he and his family must be leaders and take active roles in their community, church, and agricultural programs, that they must take pride in their home and home surroundings, and that in every single enterprise in which they engage, the best is not too good. A combination of such factors really means "better living down on the farm."

The System's philosophy of "as our territory prospers, so shall we prosper" is the foundation of the Farmer for Better Living Program. The Company believes that its efforts now in behalf of boosting better living on the farm will pay dividends in future purchases of electricity and appliances by the persons whom the program reaches. In other words, first help to make farmers able to buy electricity and appliances. That they *will* buy when they have the money goes without saying.

The Farming for Better Living Program is basically the same agricultural extension program which county agents, home demonstration agents and various farm groups have been "preaching" for years. The 1943 Program has been enlivened with a few innovations, the principles of a contest added, and the Monongahela System has joined with newspapers, clubs, civic groups, businessmen, and others in making up substantial "kitties" of cash and merchandise for rewarding those farmers in each county who do the best job of following certain recommended practices designed to bring increased benefits to the farmers and their communities.

Farming for Better Living emphasizes the value of a well-balanced farm plan and aims to give recognition to those farmers who follow such a plan. The well-balanced plan implies that a farmer considers his or her farm as a production unit and apply to it the practices that will most intelligently utilize the resources of that farm. Those practices strive to make the farm self-sufficient by encouraging the farmer to grow and preserve food and feed, insure his income through diversified farming, and stress the advantages of better farm management.

Farming for Better Living was started in 1940 with 10 counties and about 400 enrollees. By last year it had grown to 21 counties and 1,070 enrollees. Another county has been added in 1943 and about 1,300 enrollees expected. More than 50 per cent of the 1942 enrollees completed their project work—were definitely made "better farmers."

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The enrollees who really strive to follow "better farming" practices as outlined by the extension service and by Farming for Better Living are, consciously and unconsciously, the "teachers" of those practices. Through the channels of the publicity and photos, through direct contact, and by other means, the project directors set up those farmers doing the practical successful job as good examples for other farmers to follow. Unquestionably, it brings good results. The farmers, just as the city folks, like "to keep up with the Joneses," and a certain proportion are always interested in doing things better anyway. When it comes to the point that the farmers are taking up such practices and find that they can make more money doing it, then there isn't much selling necessary. But that "millennium" is still pretty far in the future. But for every dollar of increased income a farmer has to spend, several cents of that total will eventually be spent for electricity or things electrical. And the enrollee who doesn't now have electricity may make a good customer when the war clouds are lifted and rural extensions again become the order of the day.

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(NOTE: Details of the "Farming for Better Living Program" are carried in the current issue of Rural Electrification Bulletin, published by the Institute.)

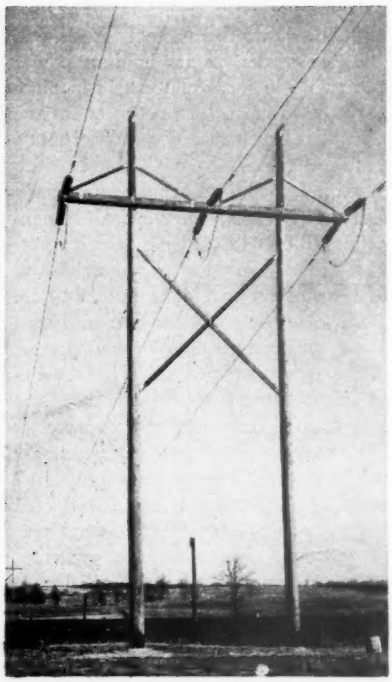

Fig. 12—DE RR Structure

empirical formula and ratio of bolt length to bolt diameter of 10. A small variation in this ratio has but little effect and the curves can be used for general applications in western red cedar poles.

DE RR Structure—Fig. 12

This structure is a straight line RR crossing structure installed several years ago. It is of interest only because it is representative of a short era, the transition period between the fourth and fifth editions of the NES Code. We have removed the longitudinal guys but the conductor dead end still remains. This structure would not be installed today. Instead it would be the tangent or conventional X-braced structure, whichever would be required to meet necessary transverse strength requirements.

Ground Rod Assembly—Fig. 13

Probably no other design factor has greater influence on the performance of a transmission line than the impedance of the connections to earth. In the desire to reduce the footing impedance to an economic minimum, use has been made for some years of single sectional rods of rather long lengths instead of short rods driven in multiple. These rods of ⅝-in diameter are of black copper bearing steel usually in 8 or 12-ft lengths and are joined by means of drive fit couplings. The sectional details of the coupling show the longitudinal serrations which form the tight joint. Specimen joints have been tested after driving to determine the fit of the couplings and with rods varying from .620 in to .630-in diameter, the holding power of the couplings is from 4000 lb to 4600 lb. With couplings of such design it is very necessary to control the fit between coupling and rod so the rod will seat properly in the coupling under either easy or hard driving conditions. The only machining necessary on the rod is to slightly bevel each end in order to remove the burr caused by the shearing operation.

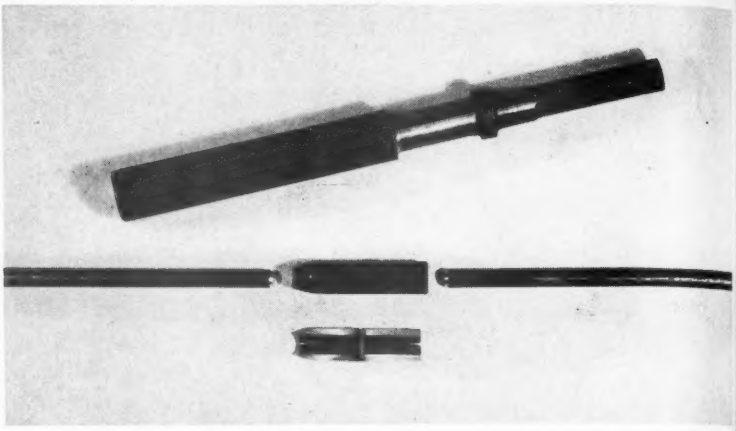

Fig. 13—Ground Rod Assembly

These rods are driven by means of a Barco gasoline hammer using the special tool shown.

(*Continued on page* 124)

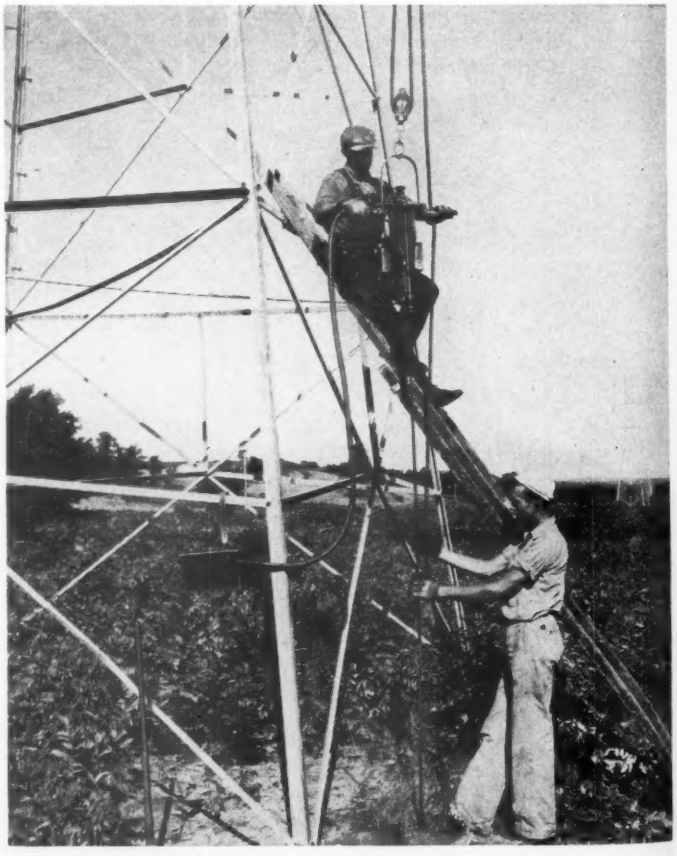

Fig. 14—Driving Rods

"As Our Territory Prospers So Shall We"

Is Long-term Philosophy of Farming for Better Living Program

By Roy W. Godley
Monongahela West Penn Public Service Company

THIS year our "Farming for Better Living" program—an important part of the Monongahela System's rural service activities—has gone to war. It is essential to the war effort because it is out on the home front fighting line pushing production of foodstuffs and trying to make the farms' family unit self-sufficient on its own acres, releasing the foodstuffs from "surplus areas" for our armies and our allies.

But it doesn't lose sight of the fact that a farmer must take care of his soil, that he and his family must be leaders and take active roles in their community, church, and agricultural programs, that they must take pride in their home and home surroundings, and that in every single enterprise in which they engage, the best is not too good. A combination of such factors really means "better living down on the farm."

The System's philosophy of "as our territory prospers, so shall we prosper" is the foundation of the Farmer for Better Living Program. The Company believes that its efforts now in behalf of boosting better living on the farm will pay dividends in future purchases of electricity and appliances by the persons whom the program reaches. In other words, first help to make farmers able to buy electricity and appliances. That they *will* buy when they have the money goes without saying.

The Farming for Better Living Program is basically the same agricultural extension program which county agents, home demonstration agents and various farm groups have been "preaching" for years. The 1943 Program has been envened with a few innovations, the principles of a contest added, and the Monongahela System has joined with newspapers, clubs, civic groups, businessmen, and others in making up substantial "kitties" of cash and merchandise for rewarding those farmers in each county who do the best job of following certain recommended practices designed to bring increased benefits to the farmers and their communities.

Farming for Better Living emphasizes the value of a well-balanced farm plan and aims to give recognition to those farmers who follow such a plan. The well-balanced plan implies that a farmer considers his or her farm as a production unit and apply to it the practices that will most intelligently utilize the resources of that farm. Those practices strive to make the farm self-sufficient by encouraging the farmer to grow and preserve food and feed, insure his income through diversified farming, and stress the advantages of better farm management.

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(NOTE: Details of the "Farming for Better Living Program" are carried in the current issue of Rural Electrification Bulletin, published by the Institute.)

ACCOUNTANTS TO MEET IN CINCINNATI

Netherland Plaza Hotel—April 27 and 28, 1943

FOLLOWING advice from the membership of the Accounting Executive Committee of the Edison Electric Institute, Mr. F. B. Flahive, of the Columbia Gas & Electric System, chairman of that committee, has announced that because of present day accounting problems and necessary changes in procedures, plans are being made for a gathering of utility accountants for an exchange of views and suggestions as to how best to meet the increasing multiplicity of problems under war conditions. It was also decided, because of the national transportation problem, that any meeting on these matters should be held jointly with the corresponding committees of the American Gas Association.

H. R. FLANEGAN
Coordinator EEI Customer Activities Group

F. B. FLAHIVE
Chairman Accounting Executive Committee, EEI

H. H. SCAFF
Coordinator EEI General Accounting Group

The mid-week dates of Tuesday, April 27th and Wednesday, April 28th have been reserved at the Netherland Plaza Hotel in Cincinnati, Ohio for this meeting, and Mr. L. A. Mayo of The Connecticut Light & Power Co., Hartford, Conn., chairman of the Accounting Section of the American Gas Association is working jointly with Mr. Flahive on plans for the meeting. The program is being arranged by a joint planning committee of the two associations, headed by Mr. O. H. Ritenour of the Washington Gas Light Company, Washington, D. C., for AGA, and Mr. H. R. Flanegan of the Philadelphia Electric Company, for EEI, assisted by accounting committee representatives of the two associations.

One-half Day General Session.

Tentative plans now being considered indicate that only one-half day will be set aside for general sessions at which the entire group will be together to hear from the industry and at least one outside speaker on the broader aspects of utility accounting in general. The major theme of this general session, as well as all group and committee meetings, will revolve around three current problems; (1) manpower shortage, including an address by a utility executive on the 48-hr week, (2) materials, including a Washington representative of the War Production Board on material regulation, and (3) other major accounting problems including recent trends in public utility regulation. Mr. H. C. Blackwell, president of the Cincinnati Gas & Electric Co. has offered the services of his organization to assist in this meeting, and will himself be present to make a short address of welcome.

There is also a possibility that there may be included in the General Session a discussion of present day accounting problems and the coordination of the answers to some of these problems into post war programs.

One Full Day Group Meetings

The Planning Committee is arranging for a full day for two or more group meetings; one group dealing primarily with customer accounting and related subjects, including present studies and results with meter reading and billing other than monthly, and problems encountered in reading meters, billing and collecting in sparsely settled territories because of gasoline and tire rationing and manpower shortages.

The Customer Accounting Activities Group will be presided over by Messrs. Flanegan and E. F. Embree, New Haven Gas Light Company, New Haven, Conn., and will embrace the following subjects:

1. The trend in customer accounting.
2. The case of bi-monthly billing.
3. Customer accounting forum.
4. Lengthened work schedules in customer activities.
5. Employee problems created by emergency operating conditions.
6. A look into the future of customer activities.

In addition there will be a forum on customer accounting, collections and customer relations.

The second group will consist of a general discussion revolving around original cost, regulation, salary stabilization requirements, personnel problems, financing, accounting for amortization of defense facilities, etc. Mr. H. H. Scaff, Vice President, Ebasco Services, Inc., New York, and Mr. R. E. Hull, United Gas Pipeline Co., Shreveport, La. will preside at the General Accounting Group meetings. In addition to standing committee assignments on depreciation and property records this group will also discuss assignments which were given last fall to joint AGA and EEI groups on the following subjects:

1. Internal auditing and internal reports.
2. Amortization of war facilities.
3. Special reserves for post war adjustments.
4. Simplification of reports.

(*Continued on page* 124)

CUSTOMER SERVICE MEETINGS

April 29-30—Edgewater Beach Hotel, Chicago

Commercial Conference on Wartime and Peacetime Problems

CUSTOMER SERVICE activities of the electrical utility companies will be the overall topic for discussion at the coming meeting sponsored by the General Commercial Committee of Edison Electric Institute at Edgewater Beach Hotel, Chicago, April 29 and 30. This will be the tenth year that a formal get-together of the men and women of the electrical industry has been arranged. Edwin Vennard, Vice President, Middle West Service Company and Chairman of the General Commercial Committee, EEI, will be general chairman of the conference.

We are at war, and the customary four days have been cut to two for that reason. There will be morning and afternoon sessions both days, and every speaker is discussing authoritatively some phase of SERVICE to millions of electrical consumers in home and farm, office, store, and factory as related to the war emergency and to post-war reconstruction.

At the Thursday morning session, the theme will be *power supply to industry* and the *Contributions of Electrical Service to Increased Production.* The availability of power has ceased temporarily to be a moot question, but there are numerous complex situations which arise, an analysis of which will be helpful to power engineers and about which they will welcome the other man's experience in dealing with them. OUR FIRST JOB—WINNING THE WAR will be informative on cooperation with war industries from all viewpoints. BETTER LIGHTING FOR GREATER INDUSTRIAL PRODUCTION will outline the program ahead for a joint effort of manufacturers and utilities in a National Check-up of illumination levels in war production plants.

For the afternoon session that same day there has been selected highlight subjects both of immediate interest and of the months beyond. Such subjects will be presented as HOLDING CUSTOMER GOOD-WILL IN THE WAR EMERGENCY, which will be enlightening on the subject of appliance maintenance together with food and nutrition, victory gardens and War Bond sales cooperation with government. Another presentation will be on PLANS FOR SELLING TODAY—DELIVERING TOMORROW. Most widely heralded of these "plans" was the one developed by Rolf Nugent of OPA. It lost its supporters as too involved but it had the advantage of concentrating public opinion on a general concept. Several other plans have been created. Hartford Electric Light ventures a test of

EDWIN VENNARD
Chairman, General Commercial Committee, EEI

the idea with its own simplified activity. The U. S. Treasury has been cold to all such plans to help sell bonds. But let us note that for the first Federal Income Tax payment more than five times the number of holders sold their Series E bonds than was anticipated. April brings another stupendous quota of new bonds which must be sold to help finance the war. Will Treasury officials warm up to another way to stop inflation through investing now in durable consumer goods for later delivery? Hear all about it at the EEI April meeting.

What can electricity do to help in greater food production? The government has expressed recognition of the farmer's plight in manpower, and in working toward a practical solution is increasing quotas of farm equipment and is making greater allocation of materials to the manufacturers to back it up. ELECTRICITY AND FOOD PRODUCTION will be discussed on this commercial program. Another important presentation will be an analysis of present utility business and marketing plans of the future to produce net, a vital subject giving valuable information to all who hear it.

Peacetime problems of electrical service supply will be featured in a POST-WAR SYMPOSIUM on Friday morning, April 30. Among the subjects chosen are LOOKING FORWARD TO PEACETIME, which covers all industry in scope; NEW PRODUCTS AND METHODS OF DISTRIBUTION as the manufacturer sees it; NEW POWER LOADS FROM NEW FARM PRODUCTS, and PLANNING TIME IS NOW FOR THE UTILITIES.

The chairman of the Commercial Planning Committee, George E. Whitwell, Vice President, Philadelphia Electric Company, will preside.

A Luncheon Session following will close the meeting. One will hear interesting speakers of prominence on subjects of vital import at this session. Those attending the Conference from long distances will have ample time at the close to catch the late afternoon trains for a weekend return home.

In a war year there are few electrical meetings as compared to normal times and yet there are just as many problems of customer service, even more to confront commercial people. These meetings will afford opportunity for hearing latest information and getting stimulation of thought which will assist in solving local problems efficiently and effectively.

The meetings are open to electrical utility men, manufacturers, and all others cooperating with industry for better electric service to help win the war. They will give greater force to the reconstruction efforts of peacetime.

PERSONALS

T. D. CROCKER, president, has announced that four business men chosen from territory served by Northern States Power Company, Minnesota, were named to the Board of Directors of that company at a recent meeting of the Board. They are: STEPHEN P. DUFFY, secretary-treasurer-manager, Hall Hardware Company, Minneapolis; BRADLEY C. MARKS, president, Ancient Order United Workmen, Fargo; THOMAS A. PHILLIPS, president, Minnesota Mutual Life Insurance Company, St. Paul, and THOMAS G. HARRISON, vice president, Winston & Newell Company, Minneapolis.

Mr. Crocker said that this is the first time that representatives of the territory served by the Company, other than its officials, have had a place on its Board.

Governor Harry F. Kelly, of Michigan, has announced the appointment of JAMES H. FOOTE, Supervising Engineer of The Commonwealth & Southern Corporation, and Chief Engineer of the Consumers Power Company, as a member of the State Board of Registration for Architects, Professional Engineers and Land Surveyors for a seven-year term expiring January 1, 1950. This Board has the important responsibility of administering the law relative to the registration of architects, professional engineers and land surveyors as established by the State Legislature in 1937.

Mr. Foote has been a practicing engineer in the State of Michigan for more than a quarter century and is recognized throughout the United States as an outstanding engineering authority on the design and operation of electric power systems.

Son of James B. Foote, one of the founders of the Consumers Power Company, Mr. Foote was graduated from Michigan State College in 1914 with a BS degree in civil engineering. He worked during 1914 for the Au Sable Electric Company as a member of a repair crew on hydro plants, but his unbroken service record dates from September 20, 1915, when he entered the distribution engineering department of the Eastern Michigan Power Company.

In 1916 he became assistant distribution engineer for Consumers Power Company, and in 1920 he became electrical engineer in charge of electrical station and transmission line design, studies, reports and other matters. Later he held important responsibilities with the old Commonwealth Power Corporation, Stevens & Wood, and Allied Engineers. Since 1936 he has been in charge of the General Engineering Department of The Commonwealth & Southern Corporation, Northern Division.

C. J. STRIKE, president of the Idaho Power Company has announced that all engineering, production, transmission, distribution and service activities of the Idaho Power Company have been consolidated into one grouping to be known as the electrical department under the supervision of R. B. KING.

B. C. RUSSELL, formerly superintendent of power, is assistant general superintendent under the new arrangement and H. M. JONES is electrical superintendent. H. L. SENGER, chief engineer, will have charge of construction and reconstruction problems as well as conducting the research and planning necessary to property expansion and the rebuilding and maintenance of present property.

Mr. King, who now holds the title of general superintendent (in charge of operation and maintenance of property) has been with Idaho Power Company and predecessor companies for 28 years. Mr. Russell, following graduation from the University of North Dakota, worked as groundman, operator and electrician for the Idaho-Oregon Power and Light Company and the Idaho Railway, Light and Power Company, which later became part of the Idaho Power Company.

Mr. Jones studied three years at the University of Utah and received his electrical engineering degree in 1916 from the University of Missouri. For a year after his graduation from college, he was engaged in the mercantile business, then joined the utility, and with the exception of the time spent in military service has been with the company since. He will complete his twenty-fifth year of service this year. A graduate of the University of Nebraska, Mr. Senger worked nine years for the Arnold Company of Chicago on miscellaneous construction and hydro-electric developments. In 1910 he spent a few months with a predecessor company of the Idaho Power Company and in 1912 became a regu Idaho Power employee.

HOWARD M. SHARP, appliance a lighting bureau manager of Buffa Niagara Electric Corp., has been a pointed chairman of the light contr committee of the Office of Civilian D fense. As chairman of the light contr committee, Mr. Sharp, along with th other members, will act as a headqu ters body, submitting findings and recm mendations to the national headquart of the Office of Civilian Defense f dissemination throughout the count Mr. Sharp is senior vice-president of t Illuminating Engineering Society and member of the British Illuminating E gineering Society.

H. B. ROBINSON, manager of the e gineering and operating department the Carolina Power and Light Compa Raleigh, N. C., has been elected a vi president of the company. Mr. Rob son joined Carolina Power and Li in 1925 as a relay engineer and held va ous positions in the engineering and op ating department until 1938, when became its manager. His departmen responsible for system planning and d sign, and construction of all compa electrical facilities, as well as the ope tion and maintenance of its generati stations and transmission system.

W. R. FRAMPTON, manager of t shop and test division of the South California Edison Company, retired recently, after 37 years of service w the company. L. H. BEEBE, Mr. Fra ton's assistant, veteran of 25 years of E son service, succeeded him. Mr. Fra ton joined the Edison company as a t man in 1905. With the exception about two years in distribution work, has served in various capacities in t test division since. He was made sup intendent of the division in 1914 a manager of the combined shop and t division in 1928. For many years was a member of the meter committee the National Electric Light Associati and was one of the first chairmen of t meter committee of the Pacific Co Electrical Association. The watth meter and its related testing facili as incorporated in the Edison sys embody many of the principles c ceived by Mr. Frampton, especially new sequence outdoor meter. In t arrangement the meter is installed ab of fuses and switches, expediting m

testing and meter reading without interruption of service or other inconvenience to the customer.

R. R. COWLES has been appointed assistant engineer of operation of the Pacific Gas and Electric Company to succeed CHARLES E. YOUNG, retired. Mr. Cowles began his career with the power company in 1910, when he went to work for the Oakland Gas Light and Heat Company. During his association with P.G. & E. he has served as superintendent of the underground department in the East Bay division, as assistant engineer in the department of distribution and steam engineering and in the department of electrical construction and operation. He is a past chairman of the engineering section of the Pacific Coast Electrical Association and was general chairman of the P.C.E.A. annual convention in 1929. Mr. Young has been employed continuously by Pacific Gas and Electric since 1906.

ARCH ROBINSON has been appointed manager of the Middletown division of the Cincinnati Gas and Electric Company to succeed L. E. MARSHALL who is retiring after 27 years of service in the position and a total of 42 years in the utility business.

A number of Southern California Edison Company district managers have recently received new assignments or promotions. WILLIAM P. GRAEF is now an executive assistant of the company, remaining as special representative of the management in Long Beach, where he has been district manager for thirteen years.

JOHN H. MEAD, formerly assistant district manager of Long Beach is now district manager. H. A. BRODY, formerly Montebello district manager, has been assigned to the Huntington Park district as manager, succeeding A. I. WHITEHEAD, retired. P. V. MOFFAT, formerly Redlands district manager is now district manager of Montebello.

H. J. MOULTON, formerly San Bernardino district manager, is now district manager at Redlands, and R. J. DOYLE, formerly San Bernardino assistant district manager, is now district manager.

A. B. BROWN has been appointed general superintendent of the gas and electric operations of the Southern Indiana Gas and Electric Company, Evansville.

A graduate of Montana State College, he joined the Ohio Edison Company, Springfield, Ohio, in 1924 and was transferred to the Southern Indiana Gas and Electric Co. in 1926 as test engineer. In 1929 the Ohio River station of the company was completed and Mr. Brown was made chief engineer, with the responsibilities of organizing the plant personnel and putting the station in operation. In 1932 he was made superintendent of electric production and as such supervised the operation and construction of generating stations and major substations.

CHARLES L. HENDERSON has resigned as superintendent of operating practices for the West Penn Power Company, after 25 years of service to become sales engineer with the J. Parks Hutcheson Electrical Sales Engineering Co. of Pittsburgh. Mr. Henderson joined West Penn in 1917 as load dispatcher.

H. D. STILLMAN has been appointed assistant division manager of the Huntington division of the Appalachian Electric Power Company with offices in Huntington, W. Va. Mr. Stillman has been district manager of the Logan district for the past eleven years and has been connected with the power company for the past 20 years, since his graduation from the University of Michigan in 1923.

GEORGE B. MESSICK has been appointed superintendent of the methods division of the Philadelphia Electric Company. Mr. Messick was first employed by the Philadelphia utility in 1915 as a running engineer at Beacon station. Subsequent assignments followed to the Chester and Schuylkill stations, and then he was made assistant superintendent at the Richmond station. He was appointed acting superintendent of generating stations in 1937 and the following year was transferred to the Schuylkill station in the capacity of superintendent. JOHN FINLAW has moved up from assistant superintendent to superintendent to fill the vacancy caused by Mr. Messick's transfer.

WILLIAM K. KLUMPP has been appointed superintendent of the Chester station of the Philadelphia Electric Company, to succeed EVERETT PALMER, who will retire on May 31. Until then Mr. Palmer will act in an advisory capacity for the superintendent of the station. Mr. Klumpp was first employed by the Philadelphia utility in 1919 as an assistant plant test engineer at the Chester station. In 1927 he was made assistant station superintendent at the Delaware station, and four years ago he was appointed superintendent, the position he held at the time of his recent appointment.

ROBERT P. LIVERSIDGE, who has been superintendent at Barbadoes station, was transferred to the Delaware station to fill the position made vacant by Mr. Klumpp's new assignment. Mr. Liversidge has been a Philadelphia Electric employee since his graduation from Cornell in 1932. Entering the service as a junior engineer, he continued in this training until 1934, when he was transferred to the Richmond station. Later he was assigned to Ardmore as engineering assistant and as electric superintendent at Coatesville.

The vacancy at Barbadoes station was filled by the appointment of HENRY T. BRYANS to the position of superintendent. While attending the University of Pennsylvania, Mr. Bryans worked for Philadelphia Electric and for the Westinghouse Electric and Manufacturing Co. After his graduation he became a full-time employee of Philadelphia Electric, starting as a junior engineer. He continued in that capacity until 1940, when he was made assistant to the superintendent at Schuylkill station.

WILLIAM J. DEMAURIAC has been appointed assistant superintendent, maintenance division. Mr. deMauriac has spent his entire business career with Philadelphia Electric, having joined that organization following graduation from Pennsylvania State College in 1931 as a mechanical engineer. JULIUS N. HENTER, formerly assistant superintendent at Richmond station, has been transferred to Schuylkill station, in the same capacity. ARTHUR R. MANDEVILLE, formerly shift superintendent at the Richmond station, has been promoted to assistant superintendent at that station to fill the vacancy caused by the transfer of Mr. Henter.

W. N. LINDBLAD, assistant chief, bureau of test and inspection, Pacific Gas and Electric Company, Emeryville, Calif., has recently been appointed chief of the test and inspection bureau. He has been associated with Pacific Gas and Electric Company continuously since 1913, except for a brief period during World War I.

Accountants to Meet

(*Continued from page* 120)

5. Protection and preservation of records.

6. Streamlining of uniform system of accounts.

It has not yet been decided whether a discussion of the problems relating to materials and supplies will be included as a part of the second group or if a third group will deal solely with this matter. There is also the possibility that taxes will be discussed separately.

The Planning Committee is arranging for a series of concurrent committee meetings for the purpose of laying general plans for the new type of committee work which because of the increasingly critical condition developing with respect to transportation, hotel and other facilities will of necessity call for much of this work to be done by correspondence.

All persons desiring to attend this accounting meeting are urged to make their hotel and transportation reservations at the earliest possible date.

Wood H-Frame Design

(*Continued from page* 118)

Driving Rods—Fig. 14

Fig. 14 shows the method used to drive the rods. The method is essentially the same for wood pole lines.

The ground rods are driven to a sufficient depth so that a maximum of 10 ohms of resistance to ground is obtained. This requires on certain lines in our territory an average length of about 60 ft., although individual rods have been driven as deep as 175-200 ft.

Occasionally because of the character of the soil or because of rock strata near the surface it is impossible to obtain proper resistance with ground rods. A single, continuous counterpoise using No. 4 W&M gauge (.2253-in. diameter) solid, zinc coated steel wire is then installed. This wire like the steel overhead ground wires now installed is coated with the ASTM C weight of coating.

In the foregoing discussion and illustrations, an effort has been made to point out a few items of the H-frame line design which may prove to be of interest. The basic design rules followed and the conclusions drawn are not hard and fast. They are the result of considerable study of available data, and as far as possible were made without prejudice and they are always subject to change.

CONVENTIONS AND MEETINGS

APRIL

9-10 Midwest Power Conference, Palmer House, Chicago, Ill.
16-17 Missouri Association of Public Utilities, Elms Hotel, Excelsior Springs, Mo.
20-23 National Electrical Manufacturers Association, Palmer House, Chicago, Ill.
26-27 Minnesota All Electrical Industry Conference, Nicollet Hotel, Minneapolis, Minn.
26-28 American Society of Mechanical Engineers, Hotel Black Hawk, Davenport, Iowa.
27-28 Electric and Gas Utility Accountants Meeting, Netherland Plaza Hotel, Cincinnati, Ohio.
28-30 Missouri Valley Electrical Association, Annual Engineering Conference, Continental Hotel, Kansas City, Mo.
29-30 General Commercial Meetings, EEI, Edgewater Beach Hotel, Chicago, Ill.

MAY

10 Association of Iron and Steel Engineers, William Penn Hotel, Pittsburgh, Pa.
10-11 Arkansas Utilities Association, Marion Hotel, Little Rock, Ark.
10-11 Electrical Equipment Committee, EEI, Edgewater Beach Hotel, Chicago, Ill.
10-11 Meter and Service Committee, EEI, Edgewater Beach Hotel, Chicago, Ill.
10-11 Prime Movers Committe, EEI, Edgewater Beach Hotel, Chicago, Ill.
10-11 Transmission and Distribution Committee, EEI, Edgewater Beach Hotel, Chicago, Ill.
10-14 National Fire Protection Association, Palmer House, Chicago, Ill.
12-13 Accident Prevention Committe, EEI, Edgewater Beach Hotel, Chicago, Ill.
12-13 Southeastern Electric Exchange, Henry Grady Hotel, Atlanta, Ga.
16-17 The Dakota Central Station Conference, Marvin Hughitt Hotel, Huron, S. D.
20-22 North Central Electric Association, Annual Managerial Meeting, Edgewater Beach Hotel, Detroit Lakes, Minn.
21-23 Westinghouse Agent-Jobbers Association, The Homestead, Hot Springs, Va.
24-26—National Electrical Wholesalers Association, Statler Hotel, Buffalo, N. Y.

JUNE

17-18 Canadian Electrical Association, Annual Meeting, Seignoiry Club, Province of Quebec, Can.

Signal Corps Seeks to Purchase Amateur Radio Communication Equipment

RADIO amateurs have been requested to sell their short-wave communication equipment to the Signal Corps, Army Services of Supply. This equipment is needed both for training purposes and operational use, the War Department has announced.

The radio communication equipment needed consists of transmitters, ranging in power from 25 watts to 450 watts and covering various bands in the short-wave range, as well as the corresponding types of receivers and such radio components as capacitors, resistors, and installation material. Especially desired are audio-frequency and radio-frequency signal generators and oscilloscopes, precision AC and DC voltmeters, ammeters and miliammeters, and other equipment for testing.

Used equipment will be purchased if it is in perfect operating condition or if it can readily be restored to such condition. The price paid for each item will be set by a Signal Corps inspector.

Persons in possession of the desired equipment who wish to sell it for use of the Army are invited to send a brief description, including name, manufacturer and model type, to Captain James C. Short at the Philadelphia Signal Corps Procurement District, 5000 Wissahickon Avenue, Philadelphia, Pa.

The complete list of the desired equipment follows:

Transmitters—Hallicrafter and Collins.

Receivers — Hallicrafter, National RME, Hammarlund, and Howard.

Meters—Weston.

Capacitors—Mica and Paper.

Oscilloscopes, Audio Signal Generators and RF Signal Generators.

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